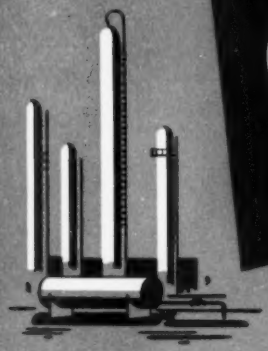
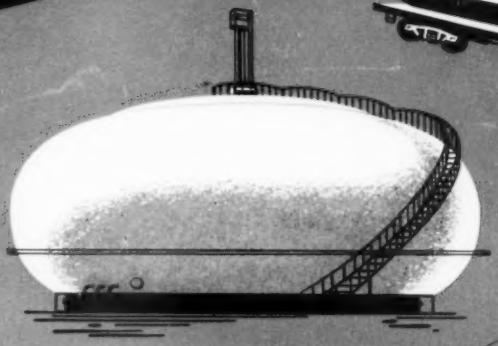
Field Processing Number

OIL AND GAS JOURNAL

Service

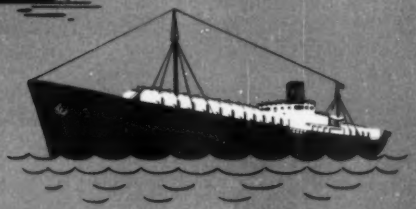


NATURAL GASOLINE
PROPANE
ISO-BUTANE
BUTANE
ISO-PENTANE



NORMAL PENTANE
HEXANE
HEPTANE
HEAVY NAPHTHA
STA-VOL-ENE

30 Service YEARS



WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA CABLE ADDRESS: Cleveland, Warren

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PRICE 50 CENTS

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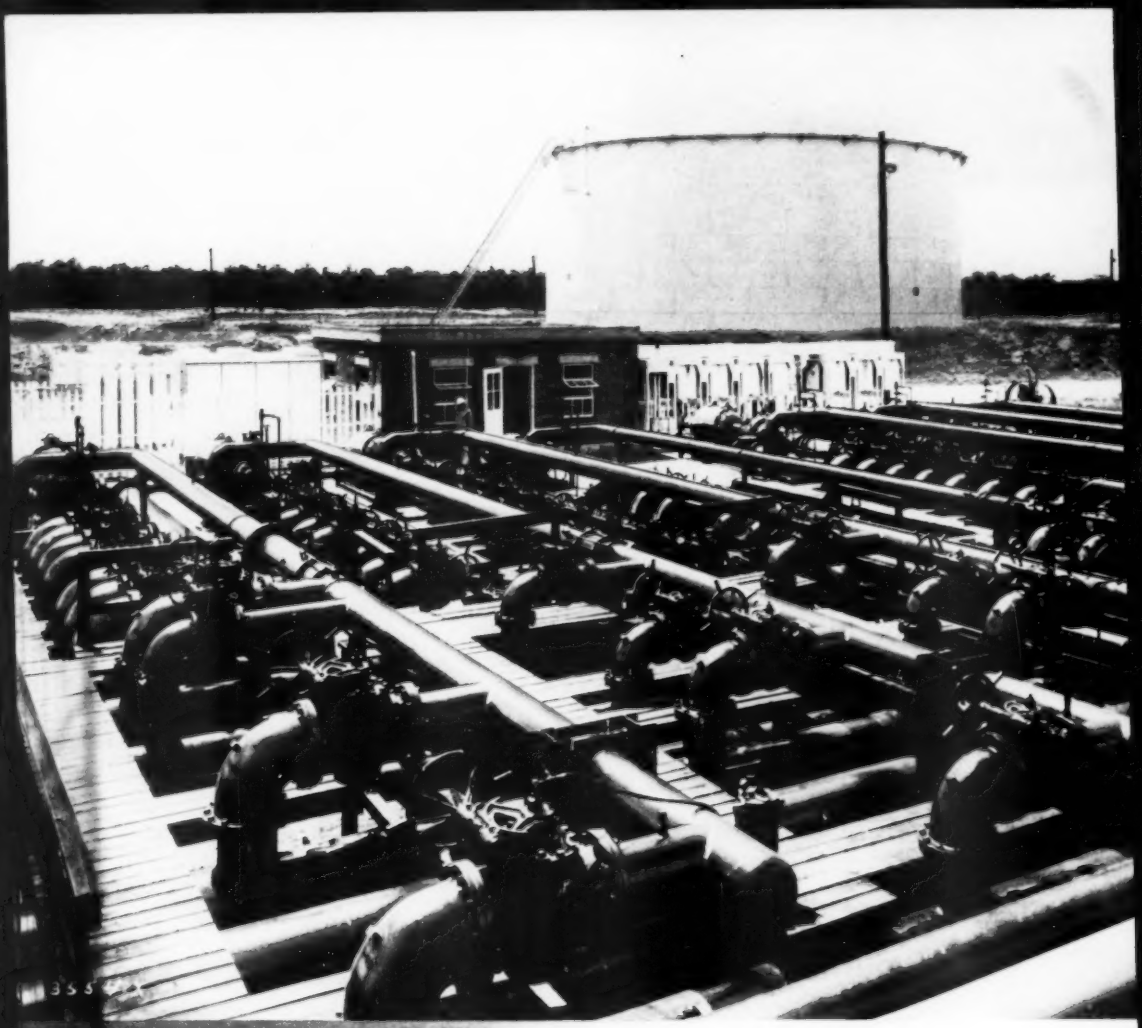


Tests Prove Nordstroms Best

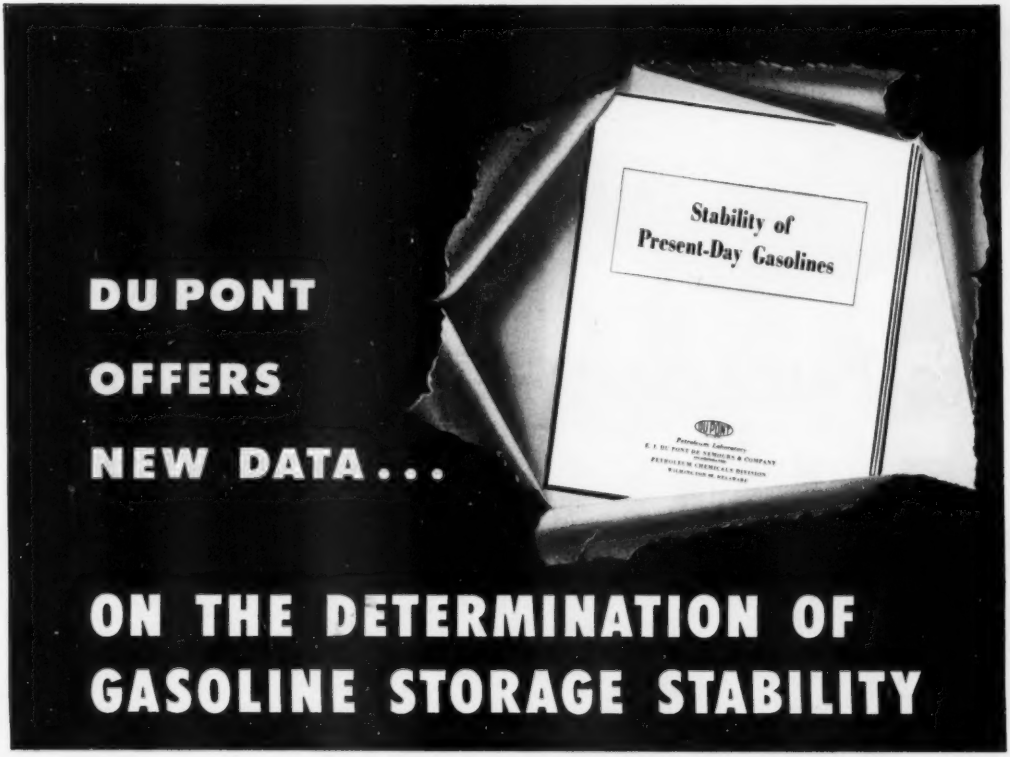
When valves are grouped in manifolds—especially in manifolds that are operated frequently—it's easy to judge performance.

In nests of valves, the advantages of Nordstroms are quickly apparent. Easy to operate . . . quick to open and close . . . the double, equipment-protecting seal of tapered plug and internal lubrication . . . all these points of superiority cause companies that have used Nordstroms in grouped installations to also choose them for the remote but key points in production, pipe line, refining and all other phases of the petroleum industry.

Wherever you are in the oil fields, there's a supply house with Nordstroms nearby.

Rockwell Built
Another Product
Nordstrom Valves

LUBRICANT SEALED TO KEEP UPKEEP DOWN



DO ACCELERATED TESTS accurately measure the stability of modern catalytic-cracked gasolines when subjected to long-time storage?

There has been a growing feeling among refiners that induction period tests do not give as satisfactory results when applied to present-day gasolines as they did with earlier fuels. To evaluate the significance of accelerated tests, the Du Pont Petroleum Laboratory recently made a comprehensive study of the problem.

THE RESULTS of this work indicate that tests conducted at different temperatures do not necessarily correlate with each other. This lack of correlation appears to be due to differences in temperature sensitivity of the gasolines tested. But it is possible to develop a correlation for a specific stock provided the types of additives are not changed.

The tests also indicate that Du Pont Metal Deactivator provides much greater storage stability than is predicted from accelerated tests . . . and that the relative effectiveness of gasoline antioxidants in storage cannot be accurately predicted by these tests.

COMPLETE DATA from the Petroleum Laboratory's tests are available to refiners in a paper entitled "Stability of Present-Day Gasolines." For your copy, contact the nearest Du Pont Petroleum Chemicals Division district office.

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IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.

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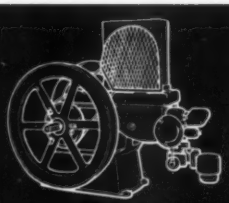
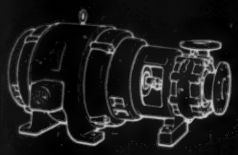
For More in Oil Field Equipment

it's FAIRBANKS-MORSE

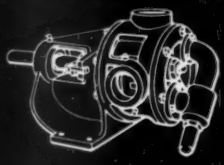
Electric Motors



ZC Engines



Builtogether Pumps

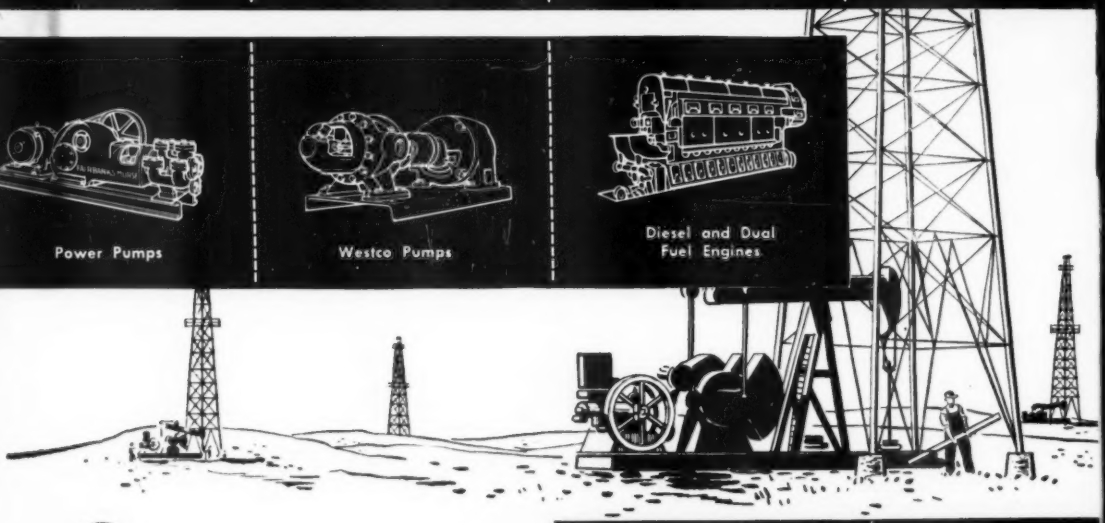


Rotary Pumps

Power Pumps

Westco Pumps

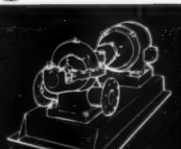
Diesel and Dual Fuel Engines



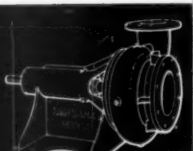
FAIRBANKS-MORSE,

a name worth remembering

OIL FIELD EQUIPMENT • PUMPS • SCALES • ELECTRIC MOTORS
LIGHT PLANTS • DIESEL, DUAL FUEL AND GASOLINE ENGINES
GENERATORS • MAGNETOS



Single and Two-Stage Centrifugal Pumps



Side-Suction Centrifugal Pumps

Proved by users from coast to coast . . .

MACWHYTE WIRE ROPE

A THOUSAND AND ONE

different ropes
Designed right—made right
PREformed and
internally lubricated

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EVERY REEL of Macwhyte Wire Rope reflects a pooling of users' experience. Over the years this experience has been studied in the field by Macwhyte engineers. Your requirements dictate the design and making of Macwhyte Wire Rope for all equipment.

Recommendations for your particular needs are promptly available either from Macwhyte Distributors or Macwhyte Company.

ASK FOR CATALOG G-15

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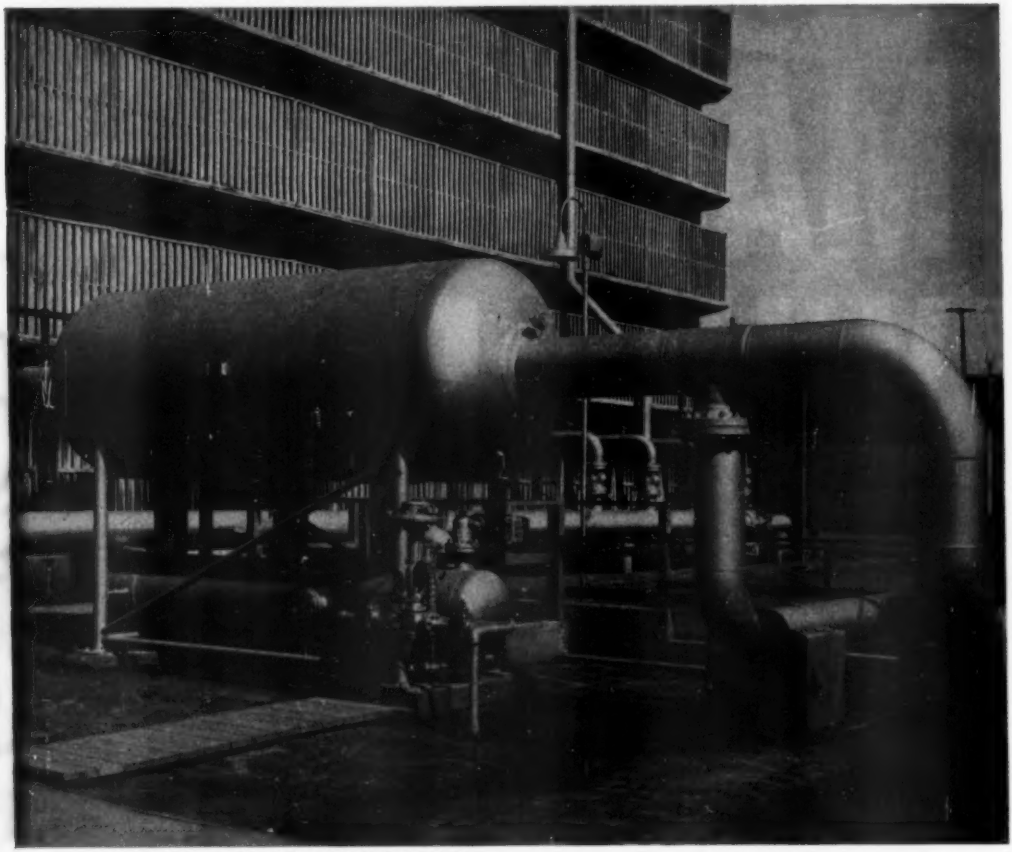
See PEERLESS FIRST!
For GAS SCRUBBERS...



The **BEST SCRUBBERS** for PIPELINES, GATHERING SYSTEMS, COMPRESSOR STATIONS, PLANT INLET SCRUBBERS

Pictured above is a Peerless 60" O.D. x 15 foot horizontal separator, handling 240,000,000 cu. ft. per day at 350#.

This separator is removing condensed liquid from the cooling tower to prevent moisture accumulation in distribution units.

Consult Peerless for an engineered solution to your most stringent entrainment problems.

PEERLESS MFG. CO.

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P. O. BOX 7193 ★ DALLAS, TEXAS ★ Dixon-8431

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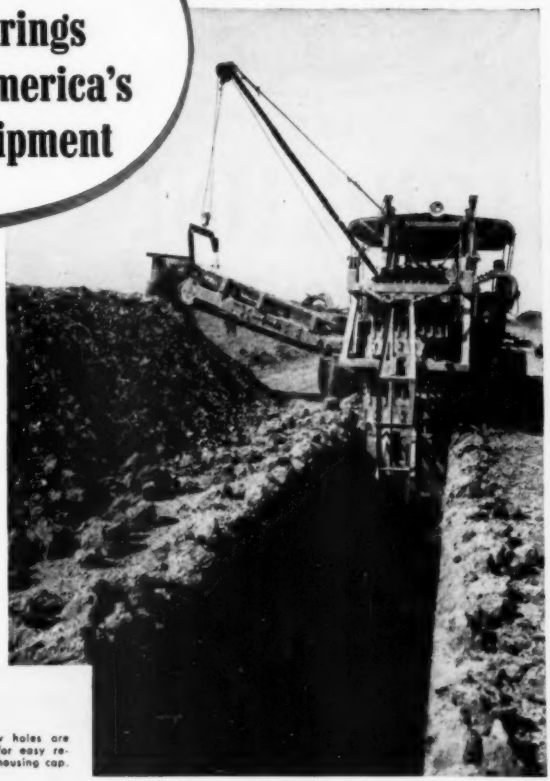
LINK-BELT

Ball and Roller Bearings keep company with America's hardest working equipment

● Oil country equipment gives bearings a tougher workout than any other service. Loads and speeds are often high and unpredictable, and bearings must work surrounded by vicious killers like abrasive dirt and dust, corrosive sour crudes, brine, drilling mud and cement slurries.

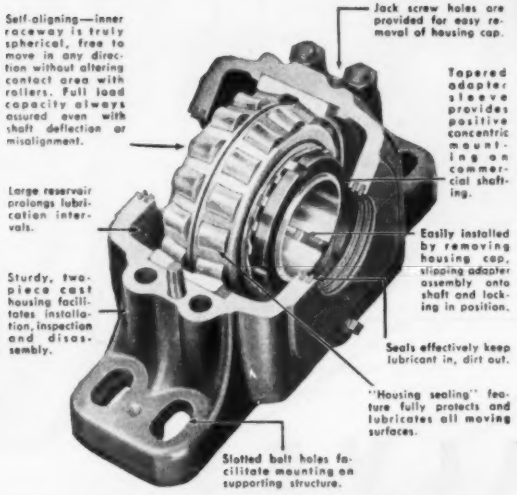
You see so many Link-Belt Bearings in the oil country because designers and users of oil-field equipment know that Link-Belt Ball and Roller Bearings assure longer machine life on the toughest, dirtiest jobs industry has to offer.

There are Link-Belt Bearings for the light jobs and the heavy ones. Let us help you apply Link-Belt Bearings to your equipment. Or call or write for Data Book 2550 for complete engineering details.



▲ Crutcher-Rolfs-Cummings Middle Incher Ditching Machine uses 14 Link-Belt Bearings on the tracks and shafts. This ditcher on a recent job ripped out a 6000 foot ditch in hard caliche and loose rock in a single 10-hour shift. The ditch was 42" wide and 5½ feet deep. The Middle Incher has averaged digging out 17 feet per minute on some jobs—that's 1360 cubic yards per minute!

CUTAWAY OF SERIES 6800-6900 TWO-PIECE ROLLER BEARING PILLOW BLOCK


Jack screw holes are provided for easy removal of housing cap.
Self-aligning—inner raceway is truly spherical, free to move in any direction without altering contact area with rollers. Full load capacity always assured even with shaft deflection or misalignment.
Tapered adapter sleeve provides positive concentric mounting on commercial shafting.
Large reservoir prolongs lubrication intervals.
Easily installed by removing housing cap, slipping adapter assembly onto shaft and locking in position.
Sturdy, two-piece cast housing facilitates installation, inspection and disassembly.
Seals effectively keep lubricant in, dirt out.
"Housing sealing" feature fully protects and lubricates all moving surfaces.
Slotted bolt holes facilitate mounting on supporting structure.

One of many types in the Link-Belt line of Pillow Blocks, Flanged, Flanged Cartridge, Cartridge, Hanger, Take-Up Blocks and Unmounted Bearings.

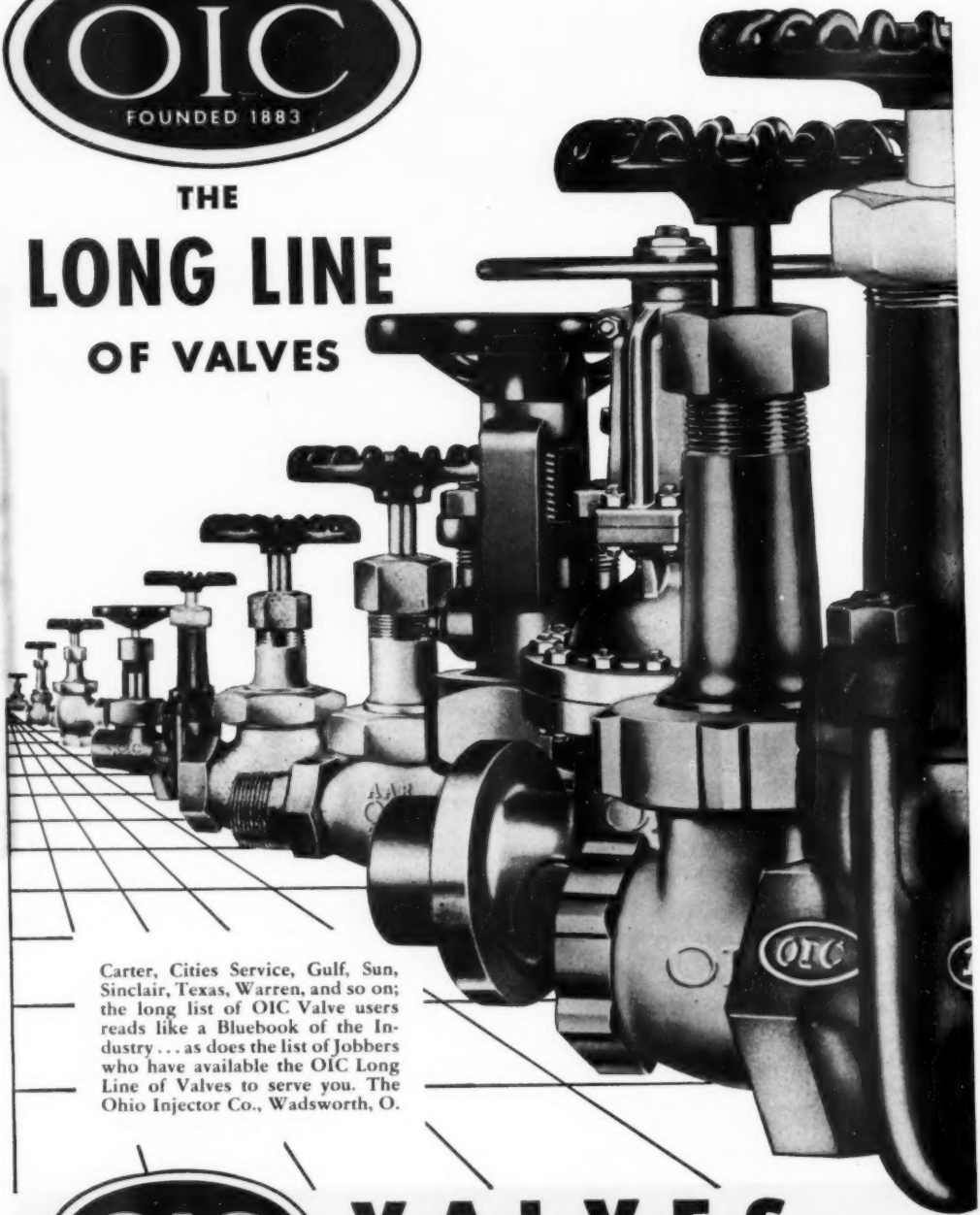
LINK-BELT

BALL and ROLLER BEARINGS

LINK-BELT COMPANY: Indianapolis 6, Dallas 1, Houston 1, Los Angeles 33, Kansas City 8, Mo., New York 7, Toronto 8. Distributors in all fields. 12,770

OIC
FOUNDED 1883

THE
LONG LINE
OF VALVES



Carter, Cities Service, Gulf, Sun, Sinclair, Texas, Warren, and so on; the long list of OIC Valve users reads like a Bluebook of the Industry . . . as does the list of Jobbers who have available the OIC Long Line of Valves to serve you. The Ohio Injector Co., Wadsworth, O.

OIC
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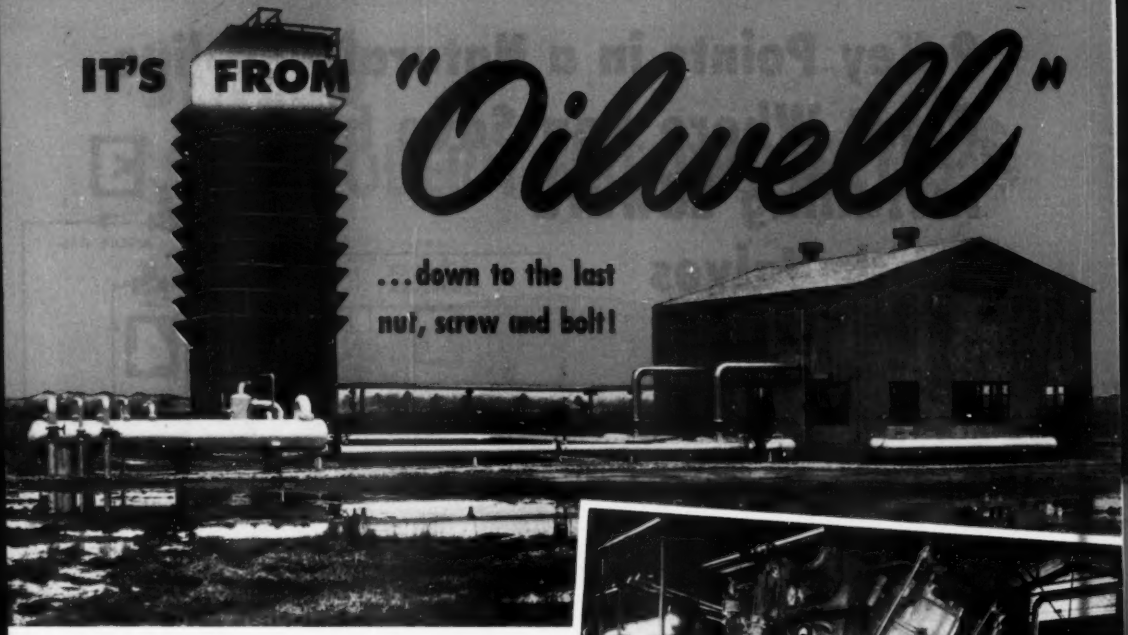
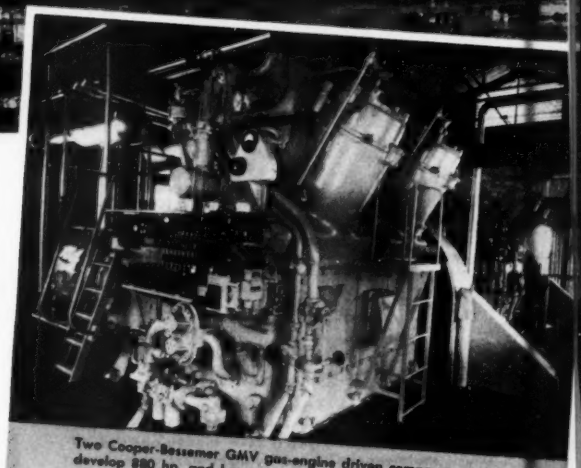
VALVES
FORGED AND CAST STEEL · IRON · BRONZE

IT'S FROM "Oilwell"

...down to the last nut, screw and bolt!





Two Cooper-Bessemer GMV gas-engine driven compressor units develop 880 hp. and have capacity to deliver 5,000,000 cu. ft. of gas at 450# pressure.

This complete GATHERING SYSTEM and GAS BOOSTER STATION

(Located in West Beaumont, Texas, Field)

. . . gathers gas that was formerly "flared"; then compresses and delivers it at 450# pressure to commercial gas lines. All operations are automatically controlled and require the supervision of only one attendant.

In addition to the building, cooling tower, scrubbers and compressor equipment shown, this installation includes a 6-mile gathering line system consisting of pipe sizes from 2" to 8", as well as a residence on the lease for the supervisor.

It was designed and constructed by Deerfield Petroleums, Inc. and is being operated by Universoil, Inc. All equipment and material was supplied by "Oilwell" . . . enabling the contractor as well as the operator to centralize procurement details at a single convenient source.

Discover for yourself...

. . . the many advantages of shifting procurement responsibilities to a long-established, fully-integrated company, specializing in supplies for the petroleum industry. The next time you undertake a development project of this type . . . bring your problem to "Oilwell."

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UNITED STATES STEEL COMPANY

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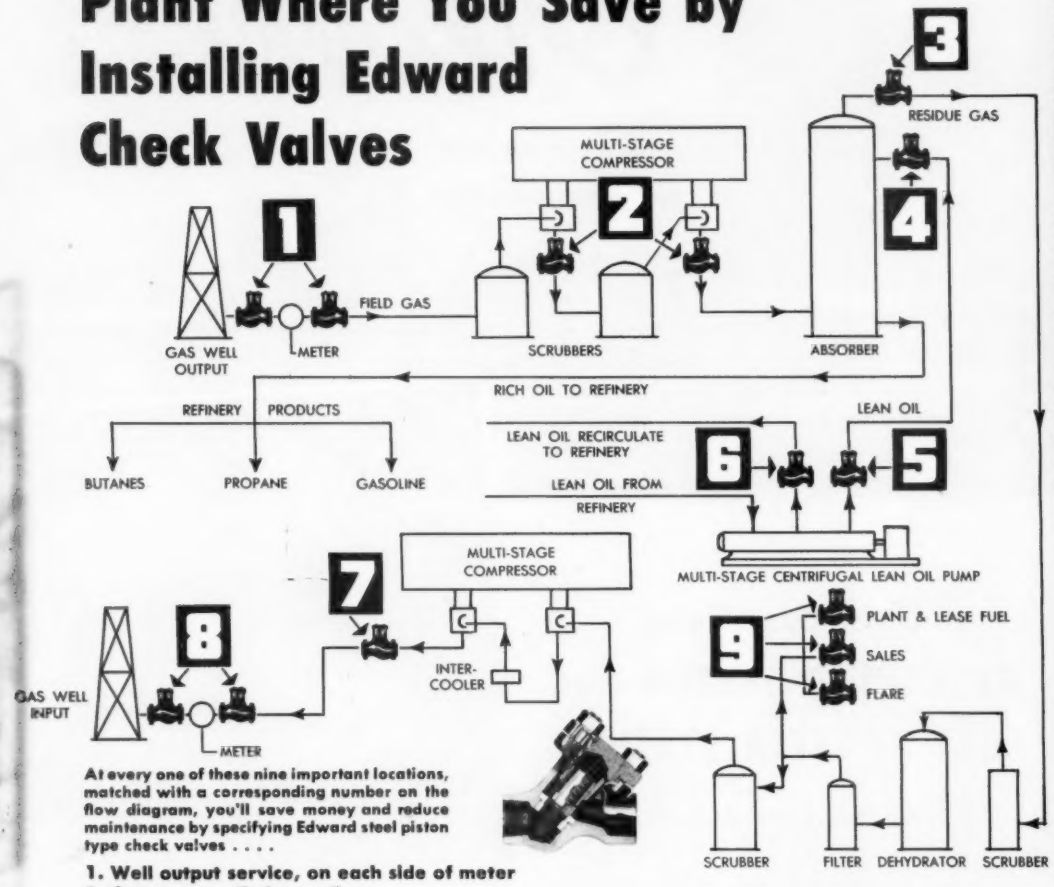
Branches Serving All Oil Fields

USS "OILWELL" TRADE MARK

UNITED STATES STEEL

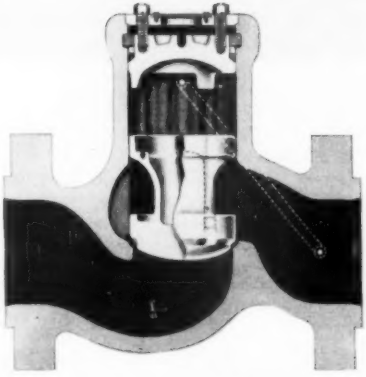
9 Key Points in a Natural Gasoline Plant Where You Save by Installing Edward Check Valves



At every one of these nine important locations, matched with a corresponding number on the flow diagram, you'll save money and reduce maintenance by specifying Edward steel piston type check valves . . . .

1. **Well output service, on each side of meter**
2. **Compressor discharge lines**
3. **Residue gas outlet from absorber**
4. **Lean oil to absorber**
5. **Lean oil pump discharge**
6. **Lean oil pump discharge recirculation to reabsorber in refinery**
7. **Compressor discharge of gas returning to field**
8. **Well input service, on each side of meter**
9. **Stripped or residue gas for internal use, sales to gas companies, or flare**

For any size line in a gasoline plant, for any pressures up to 6000 lb WOG, there's an Edward piston type check valve available. All-steel construction, with stainless steel or Stellite seats and disks. Integral body guide ribs and guide lip on disk centers it tightly on seat. No pipe-jarring slam when the valve closes. With or without piston rings, as the service requires. Full size range in all types of end connections. Write for literature.



Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

1492 West 145th Street

Another Product

SHIELD
of MODERN FIRE PROTECTION

"headquarters for the finest"

Foremost design, experienced engineering, quality materials, expert workmanship and operating superiority are all bywords of the C-O-Two Fire Equipment Company... originators of the world famous C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers.

C-O-TWO, being specialists in modern fire detecting and extinguishing equipment for many years, are constantly striving to develop new and improved types of fire protection equipment that will render highly efficient results in safe-guarding life and property from the ravages of fire.

With C-O-TWO Fire Protection Equipment, simplicity, practicability, longevity and minimum maintenance are built-in features that guarantee fast, positive action the instant fire strikes. Furthermore, extensive skill and high quality standards, together with approvals such as the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Armed Forces and Government Bureaus assure you of the finest in modern fire protection equipment.

Among the many types of up-to-date fire protection equipment manufactured by C-O-TWO, the following comprise the principal items on the market today:

- **carbon dioxide type hand and wheeled portable fire extinguishers**
- **dry chemical type hand and wheeled portable fire extinguishers**
- **carbon dioxide type hose rack and hose reel fire extinguishing units**
- **built-in high pressure carbon dioxide type fire extinguishing systems**
- **built-in low pressure carbon dioxide type fire extinguishing systems**
- **built-in smoke fire detecting systems**
- **built-in heat fire detecting systems**
- **high pressure carbon dioxide cylinder recharging equipment**

So, with current expensive delayed replacements, why not let an expert C-O-TWO Fire Protection Engineer help you now in planning modern, economical, fully approved fire protection facilities for your various properties. Our experience is at your disposal . . . no obligation of course. Get the facts today!

C-O-TWO FIRE EQUIPMENT COMPANY

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Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers • Built-In Smoke and Heat Fire Detecting Systems
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems

PIPING THAT MOVES

. . . calls for supports that are flexible

Thermal deflection of piping in the high temperature piping systems of today's oil refineries requires supports that are flexible.

Where reactive forces at terminal points in a piping system must be kept within specified limits, constant-support type hangers are recommended. They are designed to provide substantially uniform supporting force equal to the pipe load throughout the travel range and should be used on high temperature and other critical lines.

When pipe lines are subject to vertical movement and restrictive conditions do not require the use of a constant-support type, variable spring hangers are recommended. They should be designed to support not less than 85% or more than 120% of the designed load for the total travel.

When necessary to prevent abnormal movement or vibration in pipe lines, controls or sway braces of the energy-absorbing or instant-acting, counter force type are recommended.

Grinnell manufactures a complete line of engineered pipe hangers and supports; maintains a laboratory staff of trained technicians; provides highly skilled assistance and advice right from the design stage; and offers experienced field engineering service.

Grinnell Pre-Engineered Variable Spring Hangers installed in one of the largest catalytic cracking plants.

Grinnell Constant Support on piping operated at temperatures up to 1100°F.

GRINNELL MODEL L CONSTANT SUPPORTS — maintain full safety factor in high temperature, high pressure systems. 3 physical structures accommodate maximum travel requirements of 2½ 5 and 10 inches; 16 sizes collectively cover numerous load ranges between 141 and 19,530 pounds.

GRINNELL PRE-ENGINEERED SPRING HANGERS — maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes. 16 sizes available from stock — load range from 74 lbs. to 9000 lbs.

GRINNELL VIBRATION CONTROL AND SWAY-BRACES — dampen vibration, oppose pipe sway and absorb shock. 3 sizes give full deflection forces from 200 to 1800 lbs.; have initial precompressed spring forces from 50 to 450 lbs. respectively.

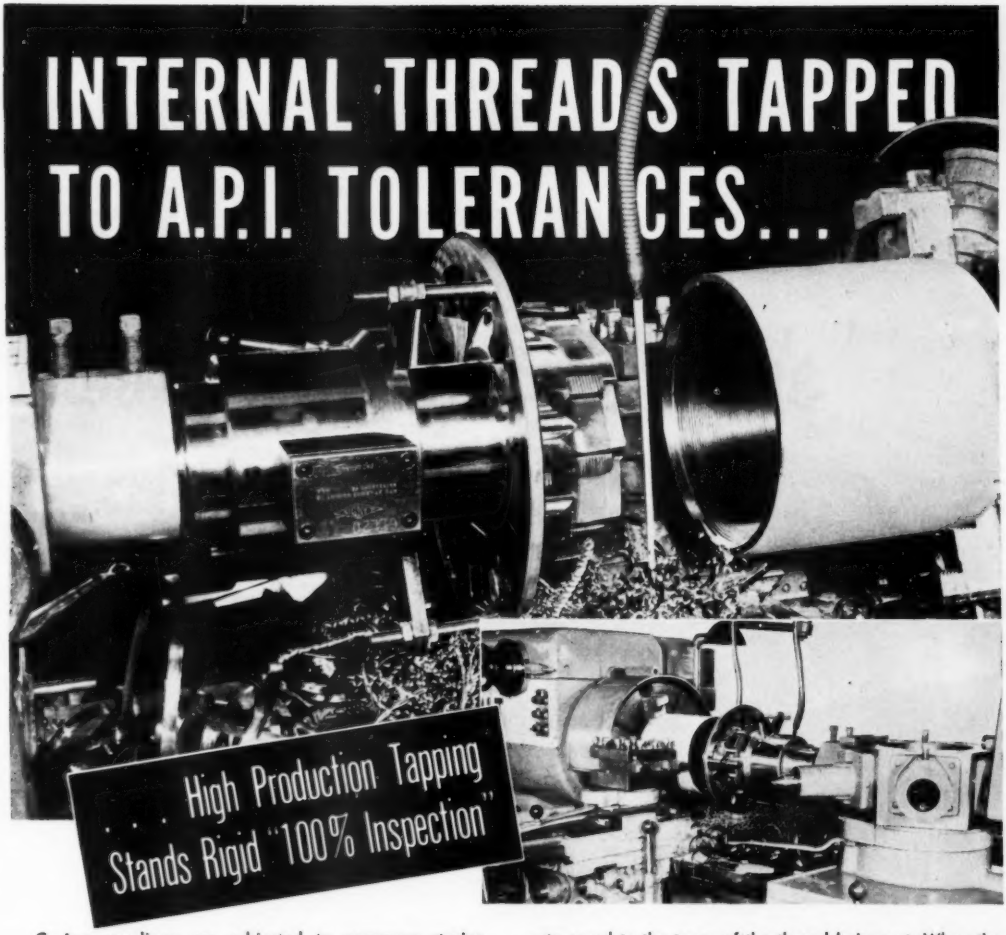
GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPLIES

Grinnell Company, Inc., Providence 1, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

INTERNAL THREADS TAPPED TO A.P.I. TOLERANCES...



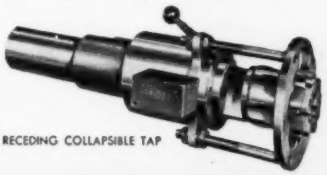
Casing couplings are subjected to enormous strains created by the weight of the suspended casing, as well as to tremendous internal and external pressures. For these reasons they require threads of extreme accuracy. Thus the prime consideration in the selection of equipment for the production of these threads is that it produce A.P.I. threads at economical production rates.

The operation shown here is one of many where internal tapered threads are cut to A.P.I. tolerances at high production rates by Landis LL Receding Collapsible Taps. 8 pitch round form threads are cut in Grade N80 casing couplings 10¾" in diameter to a length of 4" with a ¾" taper. Production is high—averaging consistently about 17 surface feet per minute. A.P.I. tolerances are met without difficulty.

Landis LL Receding Collapsible Taps are designed and built for this type of work. The receding mechanism causes the chasers to recede into the tap head automatically at a rate equal to the taper of the thread being cut. When the thread is completed the chasers collapse into the tap head, and the tap is withdrawn.

Each tap has a wide range of cutting diameters since the tap heads are detachable and interchangeable. For example, if furnished with appropriate heads, the 6LL Tap Body, shown here equipped with a 10" ALM Tap Head will cut threads in all pipe sizes ranging from 6" to 12" inclusive. The Style LL Tap Body is made in four sizes to cover a range of nominal pipe sizes from 1" to 12" inclusive.

Write for Bulletin G-95



LANDIS STYLE LL RECEDING COLLAPSIBLE TAP

LANDIS *Machine* COMPANY · WAYNESBORO PENNSYLVANIA

Represented in the Domestic Oil Fields by: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; C. J. Harter Machinery, Houston, Texas; Frederic-Baker Co., New Orleans, La.; Moore Machinery Co., Los Angeles and San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

"For outstanding we use Tiger Brand

▶ Williams-Copeland, Inc., drilling contractors of Tulsa, Oklahoma, operate ten rotary rigs. They keep accurate service records of their wire lines to determine which one gives them most for their money. The outstanding rotary line is TIGER BRAND, 6 x 19 Monitor Excellay Preformed I.W.R.C. (Independent Wire Rope Core).

"Without doubt," says Mr. Henry Robertson, tool pusher, "this is one of the finest rotary lines ever produced. We always request *American Tiger Brand* because of its outstanding performance and service."

Al Cunningham, another tool pusher for Williams-Copeland, and F. L. Musgrove, driller, agreed that TIGER BRAND Preformed Lines were the easiest to handle and gave least trouble on the job.

For other oil-field applications . . . on well-servicing rigs, cable tool rigs and pipe-line tractors, special TIGER BRAND lines are designed to give you equally good service life. Send for our handbook giving complete information on all types of TIGER BRAND Wire Rope.

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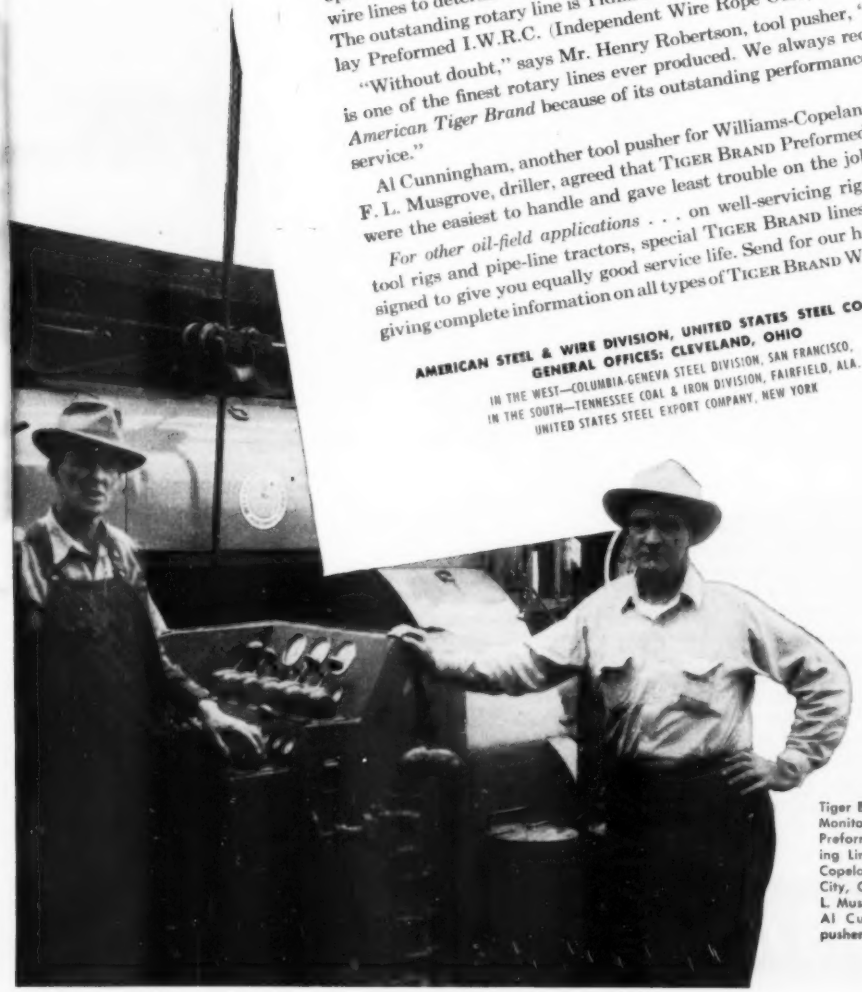

Tiger Brand 1¼" 6 x 19 Monitor Excellay I.W.R.C. Preformed Rotary Drilling Line on a Williams-Copeland Rig in the Elk City, Oklahoma pool. F. L. Musgrove, driller, and Al Cunningham, tool pusher.

performance and service I.W.R.C.

there's no better rope made"

SAYS H. ROBERTSON OF WILLIAMS-COPELAND, INC.

Henry Robertson, tool pusher says, "There's no better wire rope made than American Tiger Brand. We always request it."

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AMERICAN TIGER BRAND WIRE LINES

Excellay Preformed

UNITED STATES STEEL

Making Steeltex Lath — *Scratchboard Drawing for Pittsburgh Steel Company by T. W. Hunter*

Progress in Steel . . . *Serves The Construction Industry*

The vast construction projects you see today on every hand depend upon steel in many forms. This is one of several reasons why Pittsburgh Steel's Program of Progress was conceived—to supply more Pittsburgh Steeltex reinforcing lath to the construction industry.

Steeltex is a special mesh, welded from Pittsburgh wire and stitched by the ingenious machines shown above to heavy, waterproof, fibrous backing. It is used extensively to reinforce concrete floors, interior plaster, masonry veneer and stucco walls in all types of structures from airport buildings to housing developments—from warehouses to office buildings—in fact, wherever you find good construction.

The Program of Progress at Pittsburgh Steel is designed to increase ingot capacity by fifty percent and to diversify the Company's line of products better to serve its customers. Some of the objectives of this expansion program have been accomplished—others are rapidly nearing completion as outlined below. This Program of Progress is an important part of the steel industry's answer to the universal demand for more steel in order that military and civilian requirements for this vital metal be supplied in full.

PROGRAM OF PROGRESS

Acquisition of Thomas Strip Division	100% complete
Installation of new High Lift Blooming-Slabbing Mill	100% complete
Increase Blast Furnace Capacity by 12%	50% complete
Increase Open Hearth Capacity by 50%	60% complete
Installation of new 66-inch Hot Sheet-Strip Mill	60% complete
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Pittsburgh Steel Company

Pittsburgh, Pennsylvania

JENKINS VALVES for Safety and Economy in L.P.G. Services

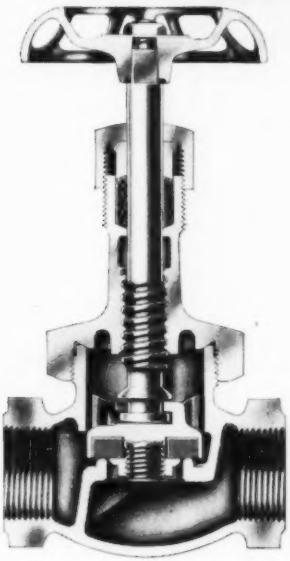

Fig. 506 Bronze Globe
400 lbs. O.W.G. ¼" to 2"

Fig. 507 Bronze Check
400 lbs. O.W.G. ¼" to 2"

Fig. 508 Bronze Angle
400 lbs. O.W.G. ¼" to 2"

APPROVED BY UNDERWRITERS' LABORATORIES,

SPECIAL DESIGN FEATURES
provide high strength and trouble-free, tight closure to meet all tests

EXTRA HEAVY, REINFORCED BODY. Liberally proportioned construction, with reinforcing rib along center line, and heavy lug ends. Will take all ordinary pipe strains without distortion, and provides a factor of safety far above any L.P.G. service needs.

CROWNED SEAT Insures positive tightness required to meet N.B.F.U. test of 500 p.s.i. under seat when valve is closed.

IMPROVED COMPOSITION DISC Meets every test of L.P.G. service. Retains resilience through entire range of liquid and gaseous phases from −50 F. to +150 F.

DEEPER PACKING BOX. Extra deep packing box and spiral, lubricated packing material permits spindle to turn with minimum friction. Dependable seal at this point and at valve seat is assured without excessive effort on handwheel.

BEVELED SPINDLE SHOULDER Back seats against corresponding bevel at bottom of bonnet when valve is full open. Relieves pressure on packing material.

ALL OTHER PARTS SPECIALLY DESIGNED and proportioned to meet rigorous requirements of critical L.P.G. service. Construction features of Fig. 507 Check and Fig. 508 Angle same as Fig. 506 Globe.

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These new Underwriters' Approved Jenkins Valves for L.P.G. service offer strength and safety well beyond specified requirements. They are built to the same quality standards that make all Jenkins Valves the economy-wise choice for any service.

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Because of their superior safety features, Jenkins L.P.G. Valves are also recommended for air, gasoline, oil, and similar services where exceptionally rugged, specially tested valves are needed. For complete details and dimensions, get the new Jenkins L.P.G. Valve folder, Form 197. Use the coupon. Jenkins Bros., 100 Park Ave., New York 17, N. Y.

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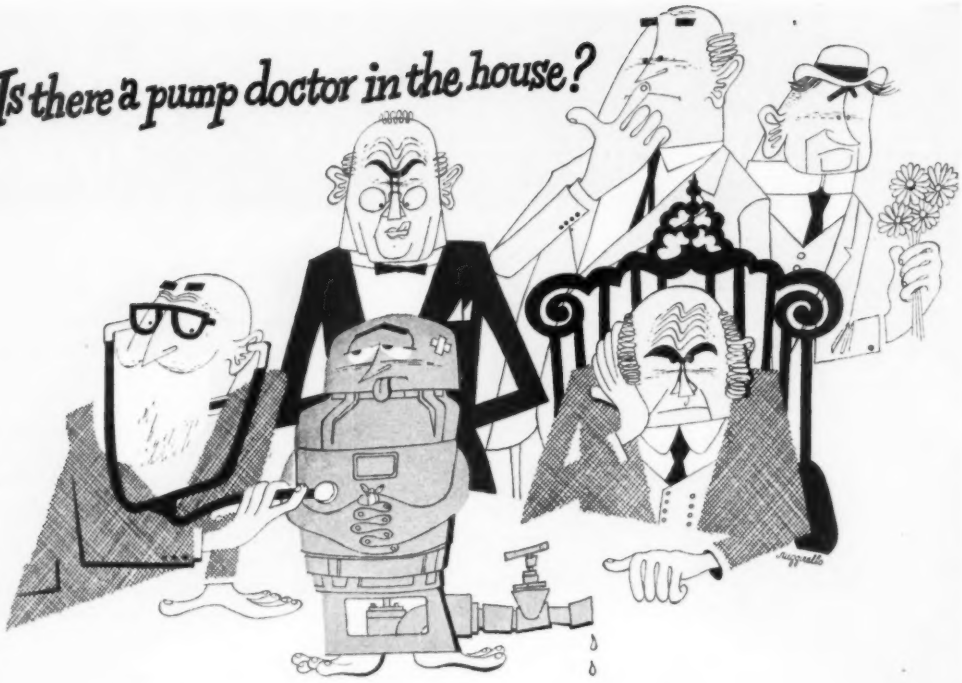

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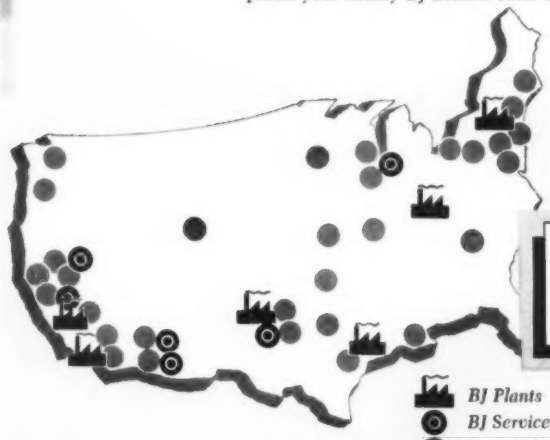

Byron Jackson pump manufacturing plants are located in Los Angeles and Fresno, Calif.; Houston and Plainview, Tex.; Lawrenceburg, Ind.; and Bethlehem, Penn.

In addition, BJ Service Shops are operated in Chicago Heights, Ill.; Chico and Lodi, Calif.; Casa Grande and Phoenix, Ariz., and Lubbock, Tex.

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Since 1872

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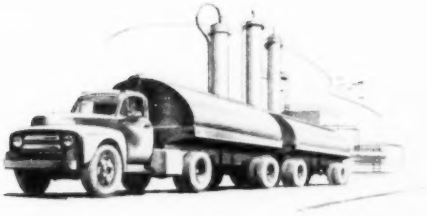

Eaton 2-Speeds will take years of heavy-duty operation. Eaton's exclusive planetary gearing better distributes gear-tooth loads, and the exclusive forced-feed oiling system provides positive lubrication even at slowest vehicle speeds. Extra rugged construction eliminates the possibility of distortion or misalignment under heaviest loads. When repair *is* necessary, practical down-to-earth design makes the work quick, easy, and economical. Eaton 2-Speeds also reduce maintenance cost on the vehicle through lower stress and less wear on engines and power transmitting parts. Ask your dealer to explain how Eaton 2-Speeds will help *your* trucks haul more, faster, longer, at less cost.

EATON

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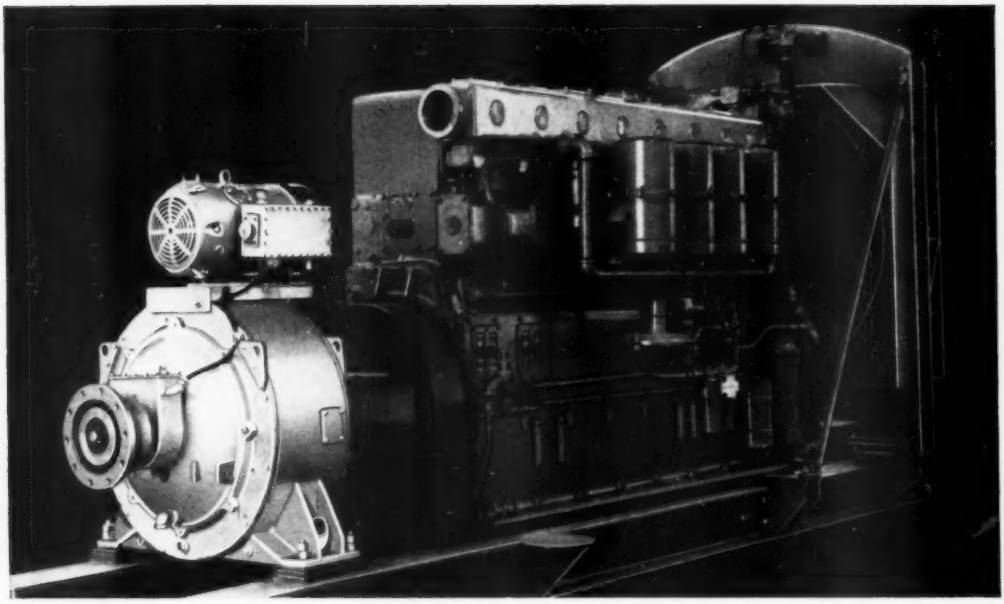

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Adjustable from 2% to 100% Slip
in Continuous Operation
Instantaneous Control • No Friction or Wear

The new Dynamatic electro-magnetic Coupling replaces the friction clutch. Slip is adjustable from 100% to less than 2%. Water cooling permits continuous operation at 100% slip with full torque. Explosion-resistant construction. Available in convenient sizes for oil field engines from 350 to 750 horsepower.

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Advantages of Dynamatic Couplings

- Engines are automatically brought to operating speed before load is applied.
- Serves as disconnect clutch.
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Dynamometers • Oil Well Draw-Works Brakes • Adjustable-Speed Couplings • Eddy-Current Brakes
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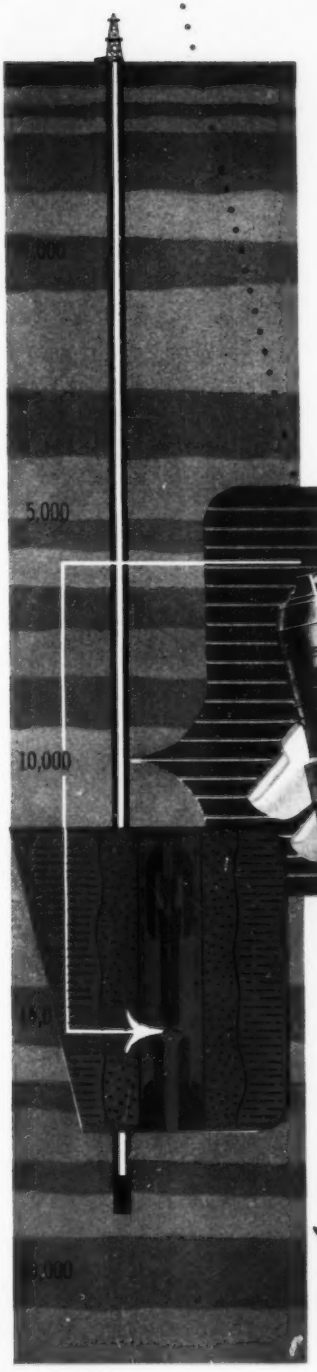
Positive Control · · · 'Way Down Deep!

HALLIBURTON
DM AND DC SQUEEZE PACKERS



Heavy muds, high temperatures, pressures as extreme as 10,000 lbs psi mean nothing to precision-tooled Halliburton DM and DC Squeeze Packers. These tools are designed and ruggedly built to take anything your casing will stand and more.

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You are in complete control of circulation in either direction at all times... Setting is positive by simply rotating the tubing or drill pipe... Slips, automatically released, grip casing with vise-like airlock seal, regardless of well pressure... Tubing and circulation valve are easily freed from packer after setting, no threads to unscrew after squeezing ...Two fluid seals prevent cement from escaping through top of packer.

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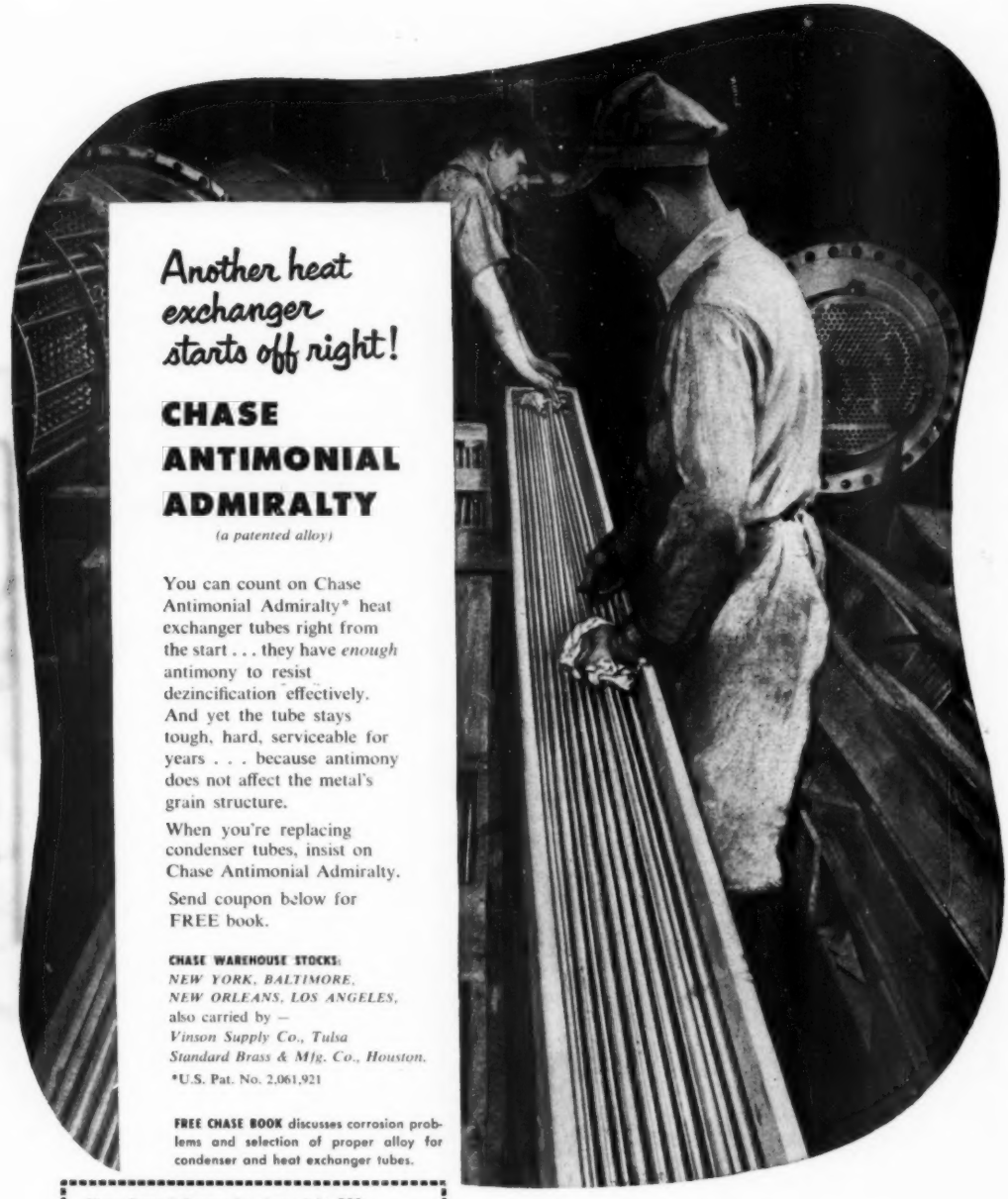
Next time, get the satisfaction of *knowing* you're on target with Halliburton's improved DM or DC Squeeze Packer. Phone your nearby Halliburton representative. Halliburton Oil Well Cementing Company, Duncan, Okla.

HALLIBURTON



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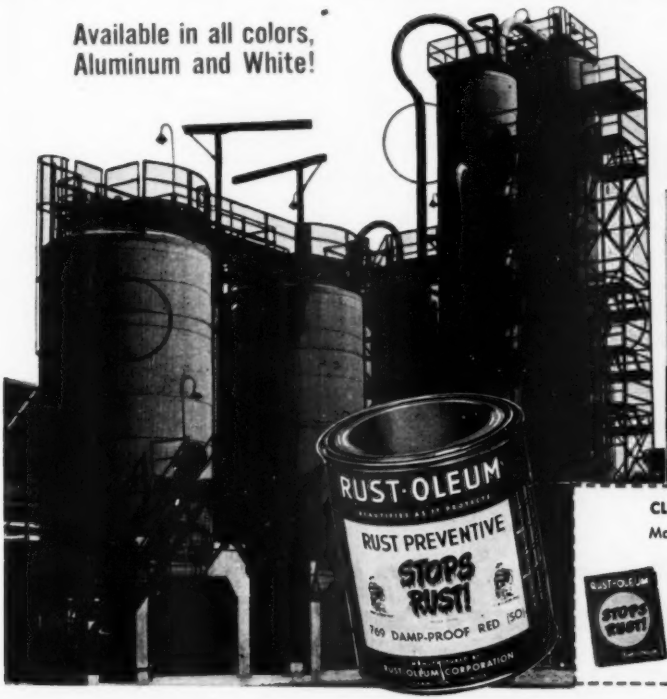
May be applied directly over rusted surfaces without removing all the rust!

Available in all colors, Aluminum and White!



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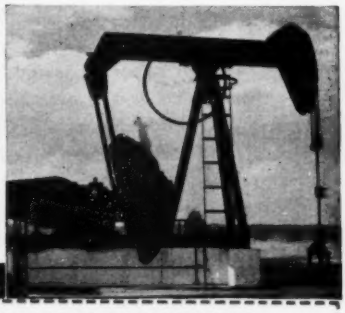

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Fig. 73

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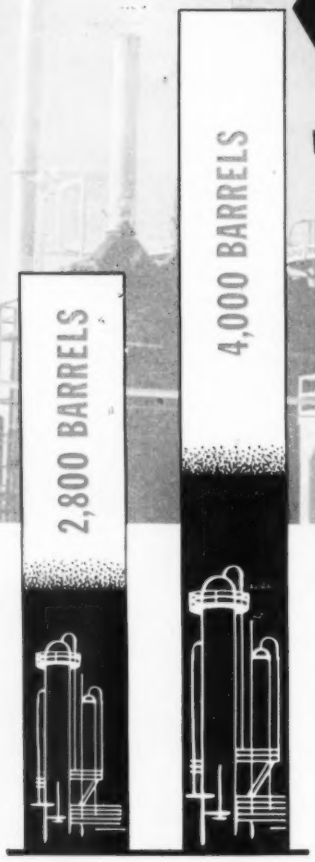
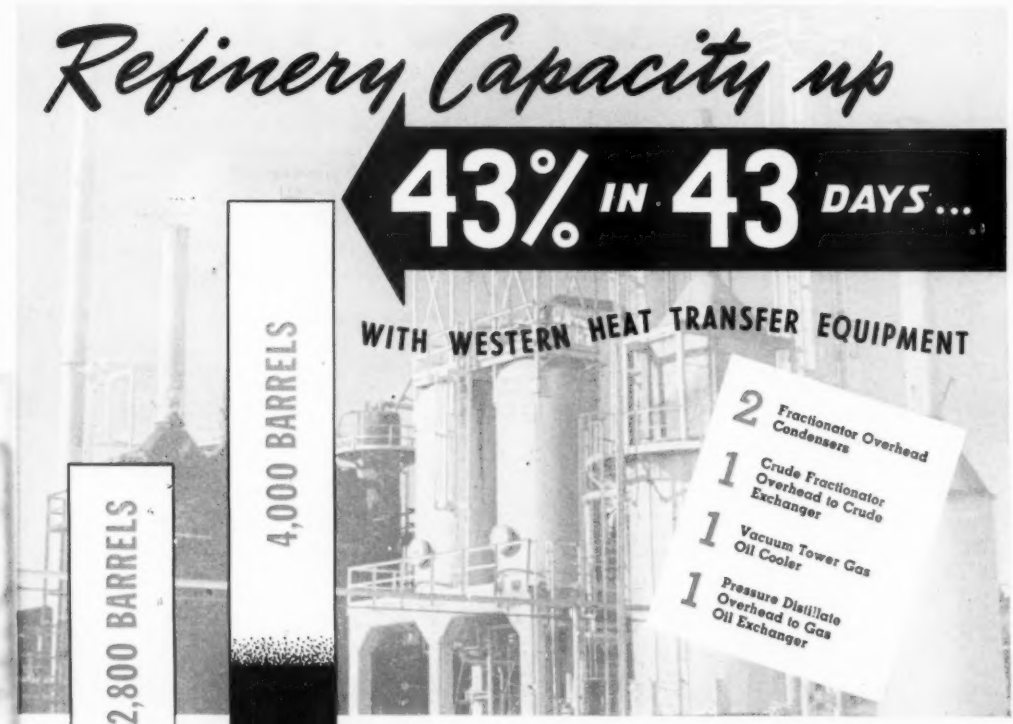
43% IN 43 DAYS...

WITH WESTERN HEAT TRANSFER EQUIPMENT




2 Fractionator Overhead Condensers
1 Crude Fractionator Overhead to Crude Exchanger
1 Vacuum Tower Gas Oil Cooler
1 Pressure Distillate Overhead to Gas Oil Exchanger

At the Shallow Water Refining Co., at Garden City, Kansas . . . an unparalleled opportunity for plant enlargement arose. A rapid increase in available crude from the immediate area made it possible to jump the throughput of the plant 43% in a matter of weeks! Shallow Water had both the tower and furnace capacity, but heat transfer installations wouldn't handle the additional load. A rush call to Western Supply Company . . . an explanation of the "now or never" situation . . . and 43 days later the critical heat exchangers were on their way to Kansas. Is it any wonder that from coast to coast, refinery, pipeline and field processing men "Look to Western" for heat transfer service.

WESTERN
HEAT EXCHANGERS

Manufactured by
WESTERN SUPPLY COMPANY
P.O. BOX 1888 TULSA, OKLAHOMA

REPRESENTATIVES:

TRIDENT ENGINEERING CO.
San Francisco, California

JACKSON ENGINEERING CO.
Los Angeles, California

ARTHUR B. ANDERSON CO.
Minneapolis, Minnesota

GIANT MORGANZA FLOOD CONTROL JOB

COMPLETED 3 MONTHS AHEAD OF SCHEDULE!

DRIVING FOUNDATION PILES for the gated portion of Morganza, La., Floodway Control Structure is one of the outstanding pile jobs of the year. Skilled planning of operations and use of two of the largest pile drivers ever built have enabled Raymond to complete this work three months ahead of schedule. Structure is supported on 3,734 precast concrete piles 80 to 118 feet in length—practically all driven on a batter.

Design and Construction under Supervision of
COL. CHARLES E. HOLLE, U.S.A., *District Engineer,*
New Orleans District, Corps of Engineers
Department of the Army.

THE SCOPE OF RAYMOND'S ACTIVITIES . . .

RAYMOND
CONCRETE PILE CO.
140 CEDAR STREET • NEW YORK 6, N. Y.

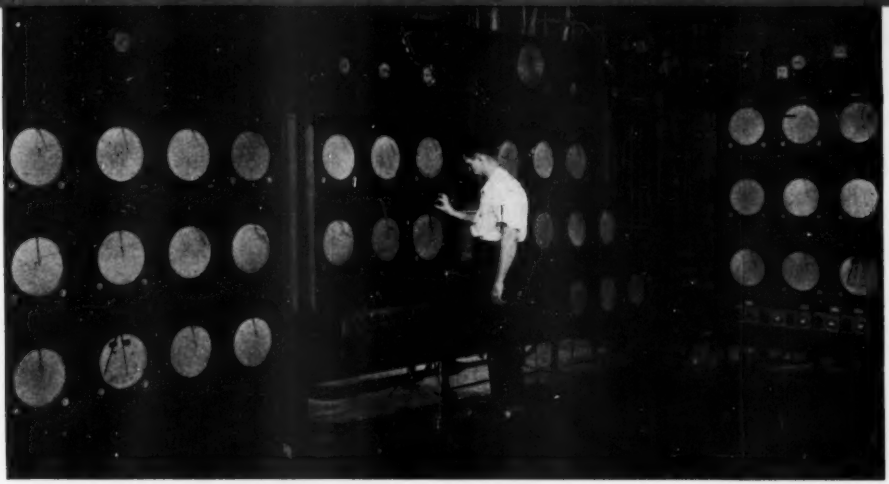
BRANCH OFFICES in the Principal Cities of United States and Central and South America.

Processing Units and (at right) Brown Control Panelboard for Plexiglas production at Rohm & Haas Company, Bristol, Pa.

BROWN INSTRUMENTATION

. . . is patterned to the exact requirements of individual plants and processes . . . is the result of engineering and application know-how, with one responsibility from sensing elements to control valves . . . is backed by a nationwide field engineering and service organization.

new molecules . . .



with the help of
Brown Advanced Instrumentation

TODAY'S tremendously increased demand for synthetic resins and rubbers is being met by greatly accelerated production of vinyl type and other polymers. Keeping pace with this gigantic effort is the production of Plexiglas at the modern Rohm & Haas plant at Bristol, Pa.

Control of every significant step in this polymerization process is synchronized by efficient, coordinated Brown Instrumentation. From a centrally located panelboard, these instruments insure precise regulation of even the most complex exothermic reactions, where process variables must stay within stringent limits.

When choosing recording and controlling instruments for your vinyl polymerization process, or *any* polymerization process, consider first:

- *Brown Creative Instrumentation—the know-how developed through many years of application experience in the industry.*
- *The completeness of Brown equipment—encompassing sensing elements, recorders, controllers, panelboards (both conventional and graphic), valves and accessories.*

For a detailed discussion of control requirements of your process, call in our local engineering representative . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4488 Wayne Avenue, Philadelphia 44, Penna.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

- *Important Reference Data*
  Write today for Composite Catalog 5000.

ROCKWELL ORIFICE METERS

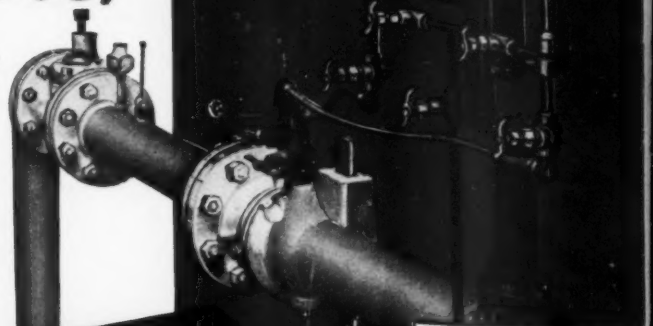
RIGHT ON THE JOB!

with IMPROVED MATERIALS, HEAVIER PARTS, GREATER ACCESSIBILITY

Right on the job . . . and right for the job, too. A favorite with the operating man who appreciates the clean-cut arrangement of internal units, the heavier parts of improved materials that permit Rockwell meters to stay on stream for long periods with minimum attention.

Management, too, has learned that Rockwell mechanical advantages pay dividends in the form of greater accuracy and longer life.

For orifice meter measurement at the lowest cost per cubic foot measured—specify Rockwell! Write for bulletin 1050.



ALL THESE FEATURES

CHART RANGE TAG

Tells at a glance the static and differential range of the meter.

LEAKPROOF STUFFING BOX

Has combination packing and bearing made of Teflon. All other parts of stainless steel. This unit is self-lubricated.

INTERCHANGEABLE HIGHSIDE CHAMBERS

The gauge can be quickly converted to any of four standard ranges—20 in., 50 in., 100 in., or 200 in. by simply exchanging one chamber for another.

SERVICE CONVENIENCE

The entire meter can be disassembled and built up using common, everyday tools.

STAINLESS PEN ARMS WITH MICROMETER ADJUSTMENT

Corrosion resistant stainless steel pen arms are painted different colors for ready identification. A simple micrometer adjustment is provided for zero setting.

ROCKWELL CHART DRIVE

Hermetically sealed. Standard type runs 8 days with one winding. Chart arbor turns once in 24 hours. Turret converters permit chart rotation rate to be changed at will.

POSITIVE INKING

Chart moves from underside of pen to top. Design prevents blurred or missing records.

THE ROCKWELL INTEGRATOR

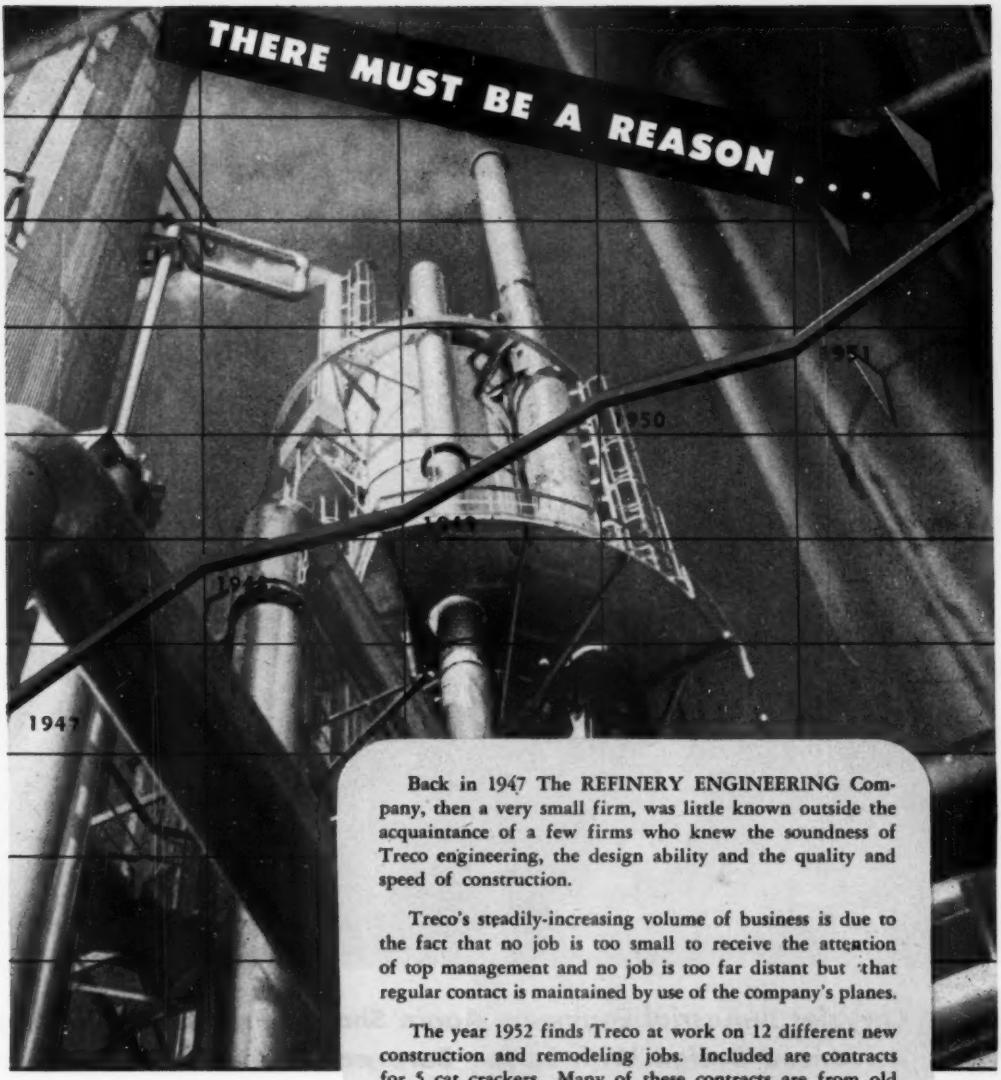
Rockwell's Famous Orifice Meter Chart

ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA. Atlanta Boston Chicago Columbus Houston Kansas City Los Angeles New York Pittsburgh San Francisco Seattle Tulsa

You Can RELY ON ROCKWELL

For Everything in Measurement and Control



Back in 1947 The REFINERY ENGINEERING Company, then a very small firm, was little known outside the acquaintance of a few firms who knew the soundness of Treco engineering, the design ability and the quality and speed of construction.

Treco's steadily-increasing volume of business is due to the fact that no job is too small to receive the attention of top management and no job is too far distant but that regular contact is maintained by use of the company's planes.

The year 1952 finds Treco at work on 12 different new construction and remodeling jobs. Included are contracts for 5 cat crackers. Many of these contracts are from old customers, which all goes to prove that *there is a very good reason why Treco continues to grow.*

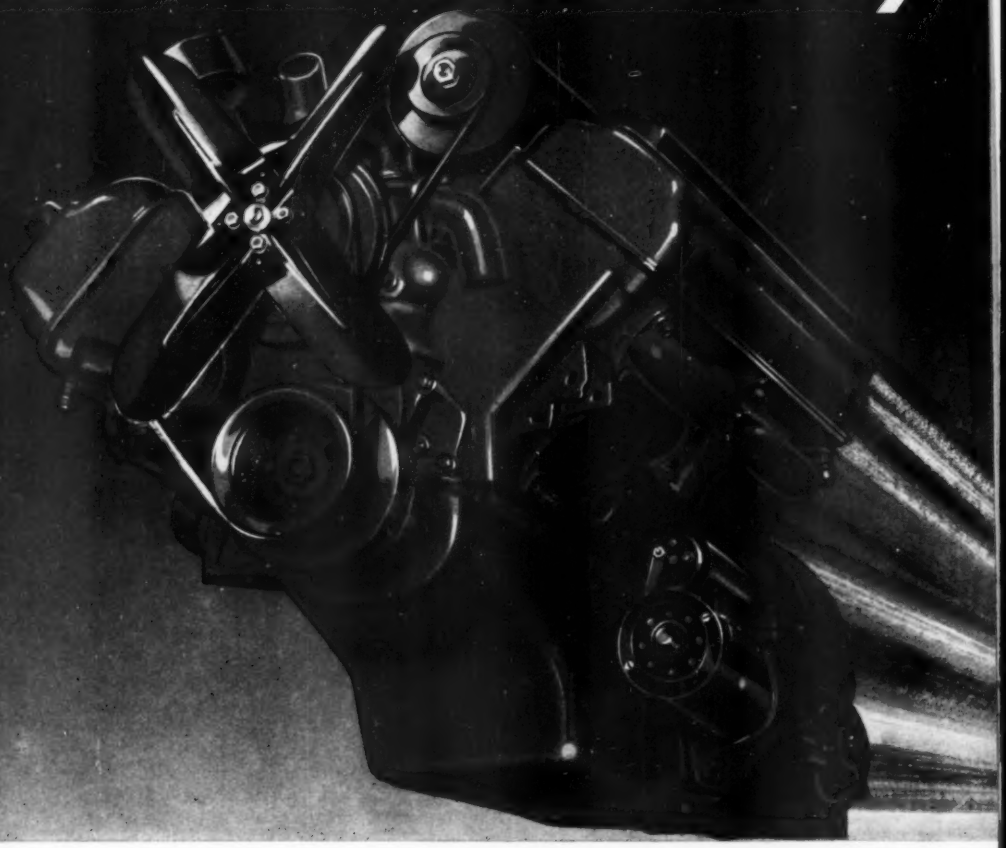
Perhaps you are contemplating building a new refinery or remodeling an existing plant. A call to Treco will bring quick response without obligation.

TRECO

REFINERY ENGINEERING *Company*

PHONE 5-5561 • TULSA, OKLAHOMA

NOW!... a Revolutionary



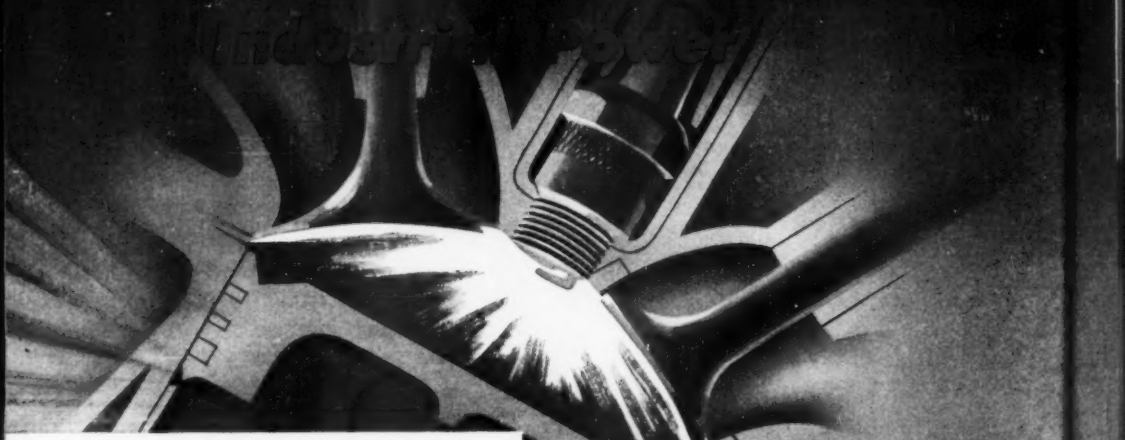
Chrysler Industrial Engineers Again Shatter Precedent! Develop Advanced Design With Larger Bore and Ingenious New Overhead Valve Arrangement! Make Long-desired Hemispherical Combustion Chamber Practical For Mass Production Methods

To the long list of Chrysler "Engineering Firsts" now is added another!

For many years, engineers have known that the Hemispherical Combustion Chamber produces the highest volumetric and thermal efficiency, exceptionally good combustion characteristics, and had excellent adaptability to high compression ratios. But all previous attempts to incorporate this design into a mass-produced engine had been unsuccessful. After five years of intensive research, Chrysler Engineers attained this goal.

With only 2.3 per cent more displacement, this mighty new Chrysler Industrial V-8 delivers *33 per cent greater maximum horsepower and a 16 per cent higher maximum torque.* Its performance is incredible. Its fuel economy is outstanding. Its durability unexcelled. In operation, it is amazingly smooth and quiet. Over-all efficiency is tremendously increased.

NEW CHRYSLER INDUSTRIAL



Yet, it has greater compactness and less weight.

Among its unique design features are a water jacketed throttle body that prevents "icing," integral automatic choke and double breaker ignition distributor.

This sensational new Industrial Engine will give you a whole new conception of industrial power and Industrial Engine performance.

Let us show you what it will do for *you*. See your Chrysler Industrial Engine Dealer, or if your job involves special engineering, write us direct. **Marine and Industrial Engine Division, Chrysler Corporation, 12200 E. Jefferson Avenue, Detroit 31, Michigan.**

CHRYSLER Industrial Engines

HORSEPOWER WITH A PEDIGREE

GENERAL SHERMAN, WORLD'S LARGEST TREE

GASO World's Best Known Portable Pumps

Specifications of the General Sherman Bigtree, Sequoia National Park: Diameter, 36½ feet. Circumference, nearly 115 feet. Height, 272.4 feet. Lumber content: 600,-120 board feet. Age 3000 to 4000 years.

We confess that no Gaso Pump has yet attained the age of the Bigtree. But we can point to many of our earliest models still doing their daily stint, with a history of economical performance that would be unbelievable were it not backed up by accurate cost records.

That's what cost-conscious buyers look for in pumping units—completely dependable service at minimum cost. And that's what makes GASO PUMPS predominantly first in the favor of pipeline men.

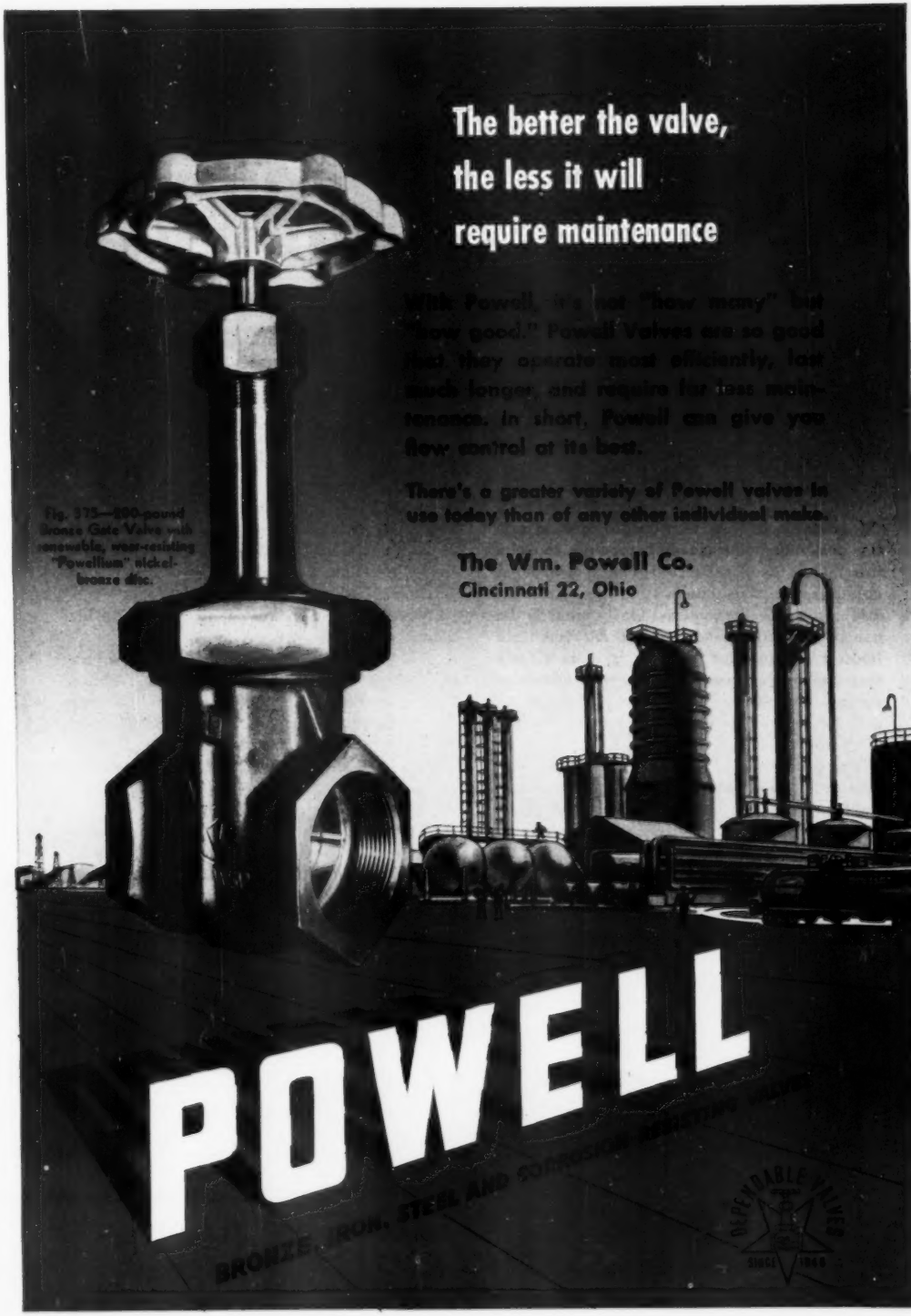
SIX FOOT MAN ON SAME SCALE AS TREE

GASO PUMP & BURNER MFG. CO. 902 EAST FIRST ST., TULSA, OKLA.
EXPORT OFFICE 149 BROADWAY, NEW YORK

Shreveport: W. L. SOMNER CO., 419 Lake Street • Los Angeles, 2329 Chambers St., Vernon • Western Canada: Lufkin Machine Co. Ltd., Edmonton, Alberta

GASO PUMPS

for every oil industry need


The better the valve,
the less it will
require maintenance
With Powell, it's not "how many" but "how good." Powell Valves are so good that they operate most efficiently, last much longer, and require far less maintenance. In short, Powell can give you flow control at its best.
There's a greater variety of Powell valves in use today than of any other individual make.
The Wm. Powell Co.
Cincinnati 22, Ohio
Fig. 375—600-pound Bronze Gate Valve with renewable, wear-resisting "Powellium" nickel-bronze disc.
POWELL
BRONZE, IRON, STEEL AND CORROSION RESISTING VALVES
SINCE 1846

Boost Pipeline Throughput ...and Cut Cost!

Of growing interest to pipeline operators is the possibility of increasing pipeline capacity through the use of gas-turbine-driven centrifugal compressors, thus conserving the steel that might otherwise be required for looping. By the use of low-compression-ratio intermediate booster stations, line pressure is more closely sustained, giving maximum flow with minimum energy input; and the need for cooling water and heat-exchange systems to cool the gas is eliminated.

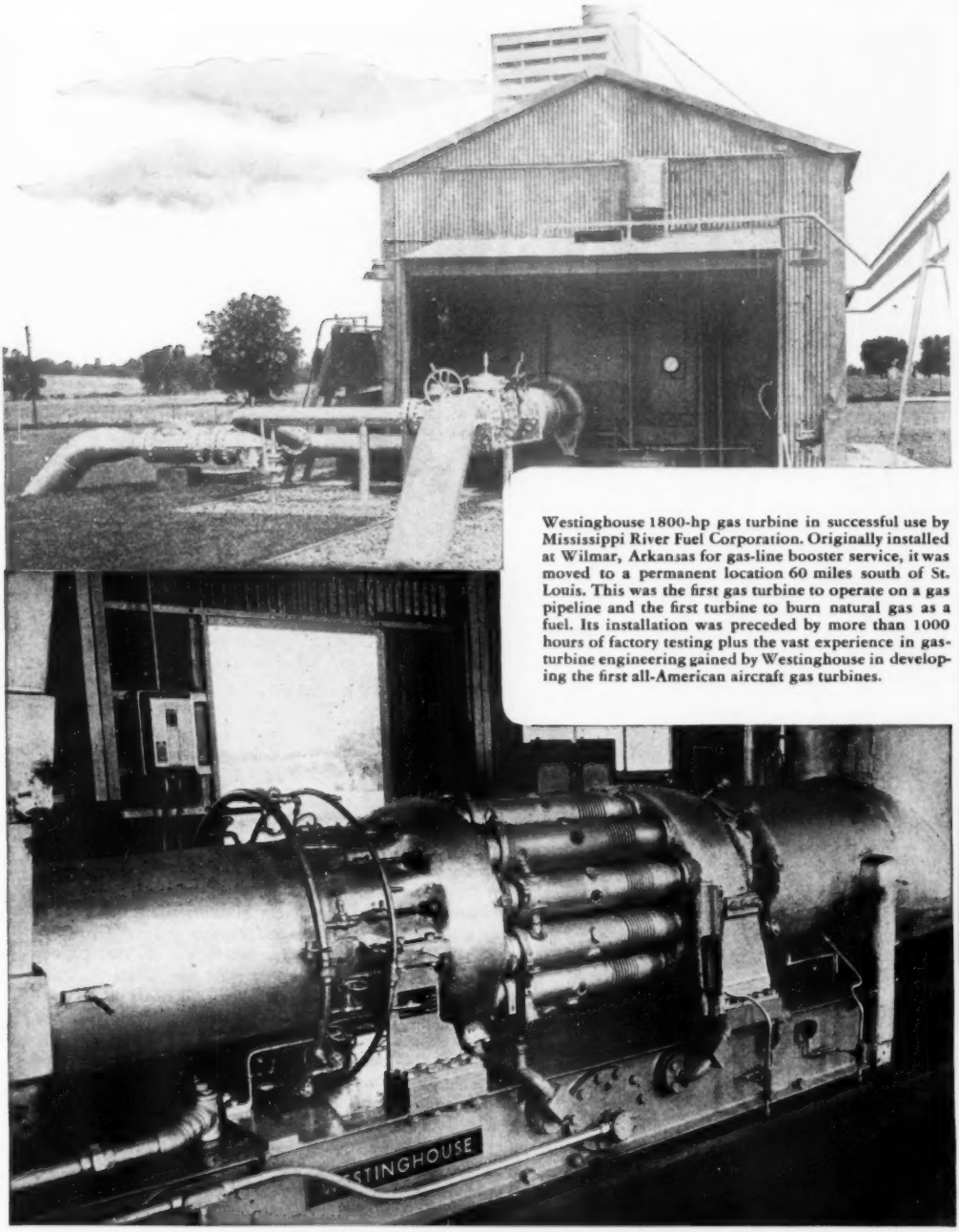
The gas turbine is simple, compact, and economical. It puts out more power per pound of weight than any other industrial power plant. Installed cost is ⅓ to ½ less, per horsepower, than for reciprocating pumping units. It is readily moved into remote, undeveloped regions, and is easily set up. It requires a minimum-cost building; and its only foundation is a 2-foot concrete slab the size of the bedplate. It requires no water, and no power for starting or for auxiliaries. It has few moving parts, it requires a minimum of lubricating oil, and maintenance is negligible. It is easily adapted for remote control of several stations from one supervisory location, and is provided with safety features that permit unattended operation.

Westinghouse now offers the pipeline industry . . .

- an 1800-hp, single-shaft, simple open-cycle, non-regenerative gas turbine, operating at 8750 rpm, with an efficiency of 17.5% at the turbine coupling.
- a 5000-hp, dual-shaft, compound, open-cycle, regenerative gas turbine, operating at 6500 rpm, with an efficiency of 25.0% at the turbine coupling.
- a 6500-hp, single-shaft, simple open-cycle, non-regenerative gas turbine, operating at 5700 rpm, with an efficiency of 21.0% at the turbine coupling.

Get the full story on this important cost-cutting development from your nearby Westinghouse Application Engineer, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50534

YOU CAN BE SURE...IF IT'S
Westinghouse
GAS TURBINES



Westinghouse 1800-hp gas turbine in successful use by Mississippi River Fuel Corporation. Originally installed at Wilmar, Arkansas for gas-line booster service, it was moved to a permanent location 60 miles south of St. Louis. This was the first gas turbine to operate on a gas pipeline and the first turbine to burn natural gas as a fuel. Its installation was preceded by more than 1000 hours of factory testing plus the vast experience in gas-turbine engineering gained by Westinghouse in developing the first all-American aircraft gas turbines.

1800 H. P. GAS TURBINE

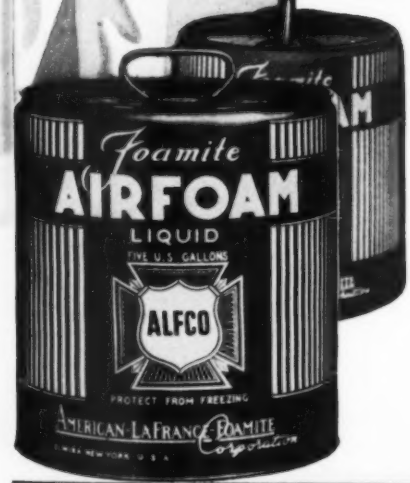
ALFCO FOAMITE AIRFOAM

The Foamite Airfoam-Generating Nozzle produces Foamite Airfoam by the scientific mixing of water, air and Foamite Airfoam solution. Light in weight, the nozzle can be moved about easily when fighting a fire.

The Foamite Airfoam it produces blankets fire with a thick, stable insulation which shuts off oxygen and smothers fire quickly and easily—and it *stays* smothered! It extinguishes fire in both ordinary free-burning materials (Class A fires) and combustible materials (Class B fires). It floats on the surface of burning liquids, quickly surrounds obstructions, and clings to solids. It prevents reflash.

Foamite Airfoam Liquid operates with fresh or salt water; with hot or cold water; will not ferment or mold; is not susceptible to decomposition from bacteria; is noncorrosive; available in 3% or 6% solution.

The Foamite Airfoam-Generating Nozzle is furnished in three capacities, model 300, 600 and 1200, producing at 100 psi operating pressure, approximately 300, 600 and 1200 gallons of Foamite Airfoam respectively. Write for literature.



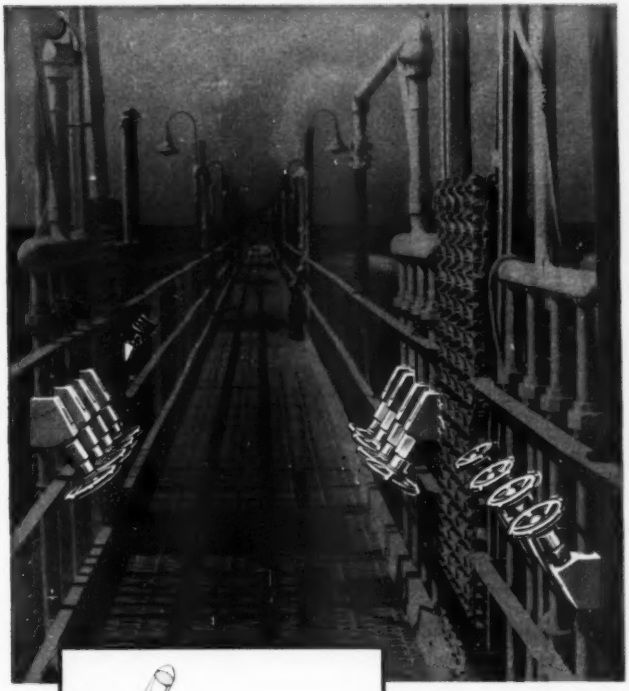
1918 Proud Continuing 1948
of Leadership in
FIRE PROTECTION

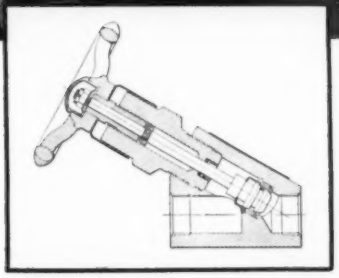
AMERICAN-LAFRANCE-FOAMITE Corporation
ELMIRA-NEW YORK-U.S.A.

ALFCO

GROVE

"V" SERIES SEAT-SEAL VALVES





- PRESSURE RANGE: TO 2000 PSI.
- TEMPERATURE RANGE: —30° TO 150°F.
- DIAMETERS: ½", ¾", 1", 1½", 2"
- AVAILABLE IN EITHER STRAIGHT-THROUGH OR 90-DEGREE ANGLE PATTERN

Longer Service, Easier Operation With Patented "O" Ring Seat-Seal

A twist of the wrist proves the superiority of Grove "V" Series Valves over conventional valves.

After thousands of opening and closing contacts at the full rated pressure of 2000 psi., ordinary hand pressure to the handwheel still gives bubble-tight shut-off. Wear and stress from constant use are practically non-existent. Grove's exclusive "O" Ring Seat-Seal is unaffected by throttling because any cutting and erosion is entirely absorbed by the plug sleeve and seat ring. Sharp particles cannot damage the Seat-Seal. All working parts are easily replaceable in the field without special tools.

For easier, trouble-free control of your loading racks, flow lines and other high pressure services, specify Grove "V" Series Seat-Seal Valves. Wire or write today for detailed technical information and specifications.

GROVE

The reliability of Grove Valves and Regulators is proved by the thousands of successful installations handling air, gas, oil, water and other fluids. For the solution to your control problems, contact the nearest Grove representative.

"V" SERIES SEAT-SEAL VALVES

GROVE REGULATOR CO. 10th and ROLLIE STREETS, EMERYVILLE, CALIFORNIA
1081 CALUMET, HOUSTON 4, TEXAS • 415 LEXINGTON AVE., NEW YORK 17, N.Y.
DISTRICT OFFICES: Dallas, Corpus Christi, Odessa, Texas — Lafayette, Louisiana — Tulsa, Oklahoma — Los Angeles, California

...WITH Harco CATHODIC PROTECTION SYSTEMS

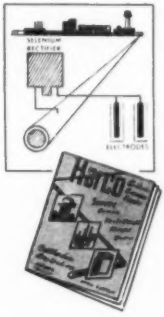
Costly, wasteful corrosion can be stopped! HARCO can design and install a cathodic protection system engineered specifically for your piping installation . . . *and only such a job-engineered system can give you complete corrosion protection.*

Factors which must be considered include soil and water chemical characteristics, soil conductivity and moisture content, temperature, seasonal variations of environment, protective coatings, dissimilar metals, position of other metallic structures and presence of stray currents.

HARCO engineered corrosion control systems result in greatly extended pipe life, lower maintenance and replacement costs, reduction of "down-time" and protection from hazards caused by electrolytic corrosion.

★ ★ ★

Write **HARCO** today for catalog containing information on cathodic protection systems or *call MOntrose 2-2080.*



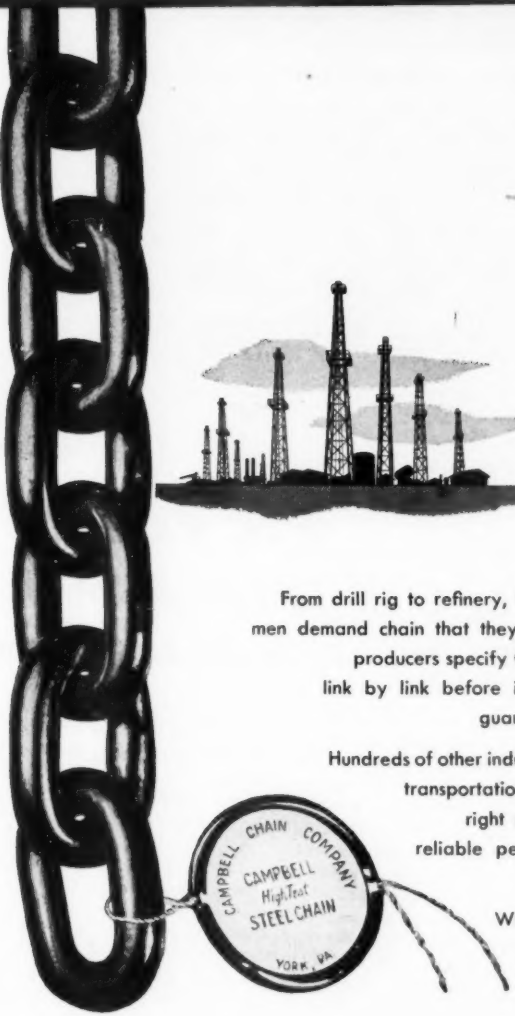
609-HC

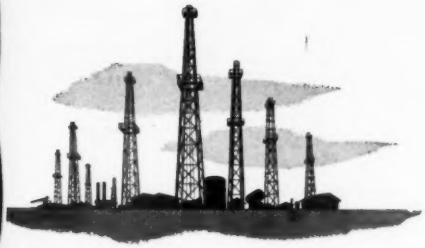
THE Harco CORPORATION *Cathodic Protection Division*

Offices in Principal Cities

16961 BROADWAY • CLEVELAND, OHIO

Oil men never take chain for granted!





From drill rig to refinery, through production and transportation, oil men demand chain that they can depend on. That's why leading oil producers specify Campbell Chain . . . chain that is inspected link by link before it leaves the factory. This is Campbell's guarantee that the chain is safe and sure.

Hundreds of other industries—among them mining, manufacturing, transportation, agriculture—look to Campbell for the right chain to fit their specific needs. Years of reliable performance have proved the long-lasting dependability of Campbell Chain.

When you need chain, for any purpose . . . in any grade, be sure to order it by the name—Campbell. Or, when you have an unusual problem involving chain, call the Campbell representative in your area. Take advantage of his experience.

Chain for every need . . . INDUSTRIAL . . . MARINE . . . FARM . . . AUTOMOTIVE

CAMPBELL CHAIN *Company*

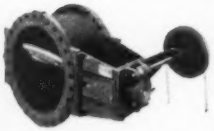
MAIN OFFICE—YORK, PA. • *Factories*—York, Pa., and West Burlington, Iowa

CAMPBELL CHAIN

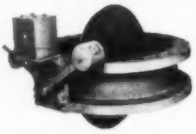
MAKERS OF FAMOUS CAMPBELL LUG-REINFORCED TIRE CHAINS

R-S valvEvents

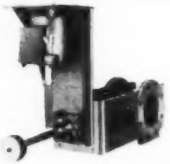
• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



WATER SERVICE—No. 825—36-inch 125-pound cast iron valve equipped with 18—8 shafts, bronze bushings and rubber seat for 85-pound drip tight shut-off.

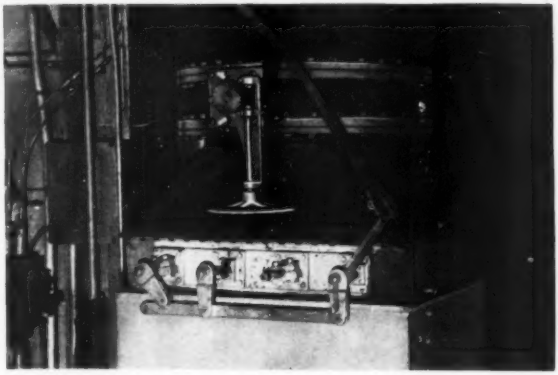


EMERGENCY OIL SERVICE—No. 628—solenoid trip valve. Should the solenoid function, the latch is tripped which causes the counter-weight to open or close the valve by gravity. Available in any metal or alloy and in various sizes for emergency shut-off or vent for air, gas, steam, oil, and water.



700° F. EXHAUST GAS SERVICE—No. 826—6-inch 125-pound R-S "H" metal valve used on small turbine generator. Equipped with 18—8 shafts, hastelloy bushings, finned lubricated stuffing box and solenoid trip mechanism.

STEAM SERVICE—No. 677—1500-pound welding end steel valve for superheated steam—A. S. M. E. Standards.



SEMI-SOLID SERVICE including abrasive and corrosive materials.

R-S VALVES

Control and Shut Off Practically Any Material

The beveled vane seats firmly at a 12½° angle and is closed from a fully open position through 77½° of arc by either manual or automatic operation. A metal-to-metal seat gives satisfactory commercial shut-off. When required, Monel or stainless steel can be welded to the vane periphery and a babbitted seat used in the valve body. Drip tight or bubble tight closure can be obtained with a rubber seat.

Power controlled prime movers delivering the necessary foot pounds of torque open or close these self-cleaning valves at any desired speed from one second to eight minutes according to requirements. Pressures range from 2 to 2500 psig and temperatures from minus 300° F. to plus 2000° F.

Such simplicity of design, adaptability and operating ease are the reasons why R-S Valves can be installed to control and shut off the volume and pressure of any material that flows or is forced through a pipe.

Obtain full details from your R-S representative.

R-S PRODUCTS CORPORATION

4600 Germantown Avenue, Philadelphia 44, Pa.

An S. Morgan Smith Company Subsidiary

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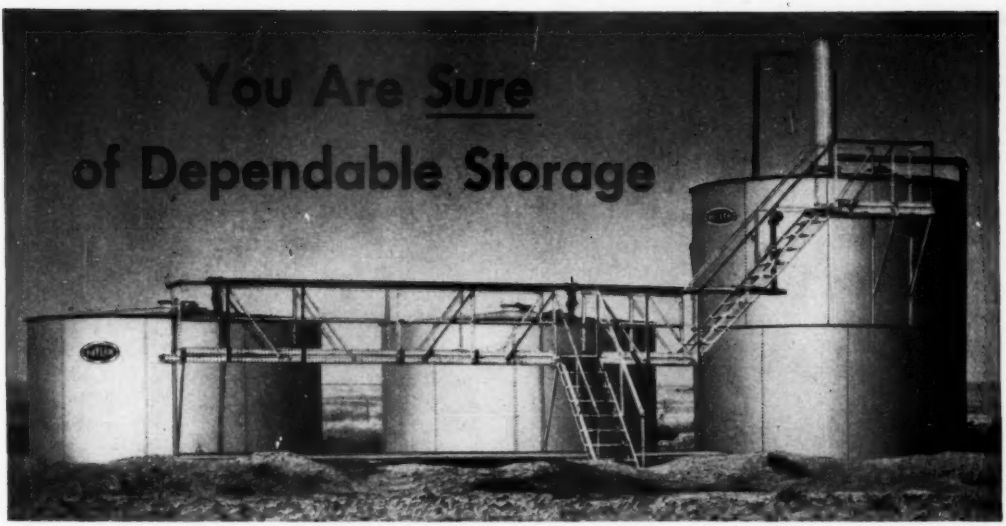

with BUTLER Bolted Steel Oil Tanks

Butler Walkways and Stairways, shown here on this battery of Butler Bolted Tanks, add safety, strength and flexibility to any installation. The next time you buy Butler Bolted Tanks, specify Butler Walkways and Stairways, too.

Extra care... extra skill that Butler puts into the engineering and fabrication of bolted tanks is your assurance of dependable storage. Each tank part is accurately engineered. Each tank sheet is formed on precision dies with precision punching to insure an oil-tight fit and faster, easier erection. Electrostatic painting gives each section uniform protection.

The next time you need a single tank or a battery—call your Butler distributor.

and You'll Always Get Dependable Service from Your Butler Distributor

Your Butler distributor is ready to give you dependable service on Butler Bolted Steel Tanks, Walkways and Stairways, Unit Heaters and other oil field equipment.

AMERICAN PIPE & SUPPLY COMPANY
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HARRY G. MILLER
El Dorado, Arkansas

UNION TANK & SUPPLY COMPANY
Fort Worth, Texas · Alice, Texas · Abilene, Texas · Great Bend, Kansas
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Odessa, Texas · Midland, Texas · Ruston, La. · Oklahoma City, Okla.
Snyder, Texas · Nocona, Texas · New Orleans, La. · Hobbs, New Mexico

W. H. CONNOR, INC.
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BUTLER

BUTLER MANUFACTURING COMPANY
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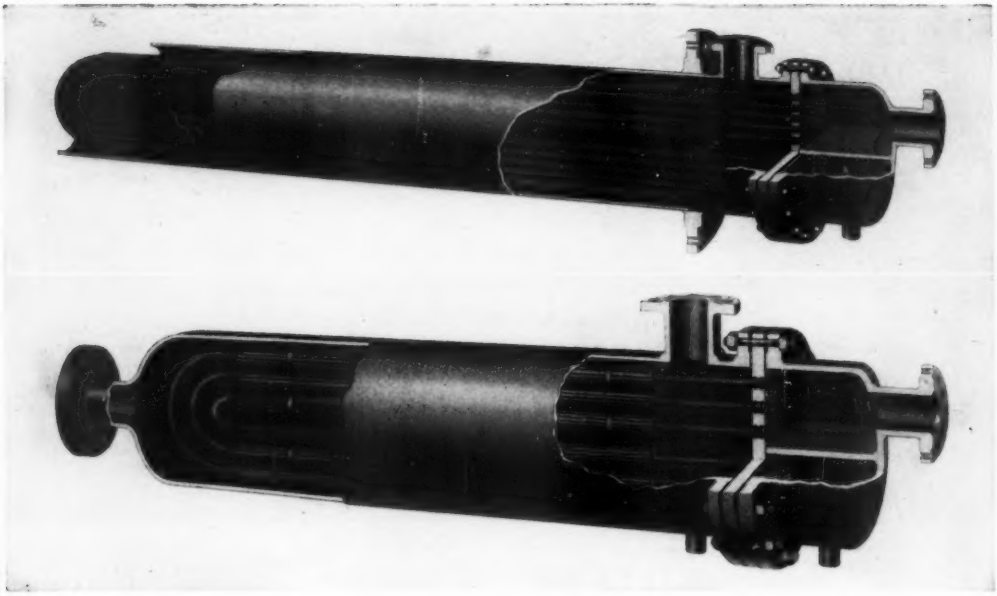


BROWN FINTUBE

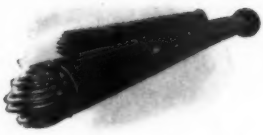
Tank Suction Heaters and Line Heaters

● Brown Fintube Tank Suction Heaters are moderately priced and highly efficient. They heat viscous oils so that they can be pumped more easily, and bolt or weld to a tank nozzle, or directly to the tank shell, so all piping and connections are made outside the tank.

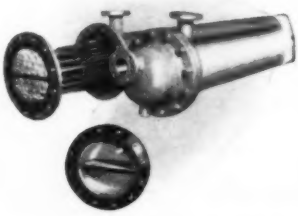
The Line Heaters are used as Suction Heaters to permit easier pumping of viscous oils; — or as Pressure Heaters, either to overcome temperature losses in long lines, or to preheat liquids for further processing.

In all cases the bundles consist of Brown Fintube hairpins rolled into the tube sheet in full compliance with the ASME codes. Metal bands, placed around alternate fintubes, prevent the longitudinal fins from interlocking and restricting the flow. This construction avoids baffling, and permits the liquids being heated to pass through the bundle *unobstructed*, in close contact with the fins and center tubes, with *low pressure drop*. Wide range of standard sizes.

Send for Bulletin No. 482. It gives full details.
Let us quote on your requirements.



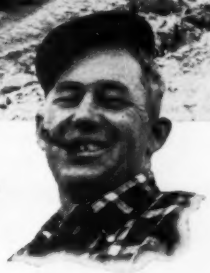
Brown Fintube Hairpin Bundles Showing the Banding of Alternate Tubes that Eliminates Baffles and Assures Unobstructed Flow.



Hairpin Bundle Assembled in Shell Showing Mounting of Tube Sheet Between the Shell and Head.

THE BROWN FINTUBE CO.
ELYRIA, OHIO

FINTUBE HEAT TRANSFER PRODUCTS



"Dodge trucks are really rated for our job!"

. . . says **L. M. HOLBROOK**, *Holbrook & Son, Santa Fe Springs, Calif.*

"Hauling rotary mud from oil fields is mighty rugged work," says Mr. Holbrook. "So it requires a truck with plenty of power.

"We carry more than 40,000 pounds of mud over makeshift roads in all kinds of weather. That kind of work just naturally calls for a Dodge. Why—with all that Dodge '*Job-Rated*' power, our work is *easy!*

"Take it from me, Dodge trucks are really rated for our job! They're powerful, dependable and economical to run."

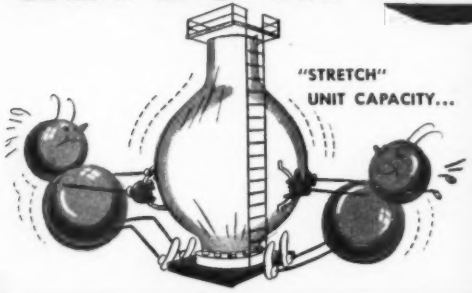
You'll find that enthusiastic statements such as Mr. Holbrook's are an everyday occurrence among men in the oil fields. They're discovering the extra power and dependability of heavy-hauling Dodge "*Job-Rated*" trucks. Further, they have discovered that because a Dodge truck is "*Job-Rated*"—factory-engineered to fit a specific job—it assures the best in low-cost transportation for many years to come.

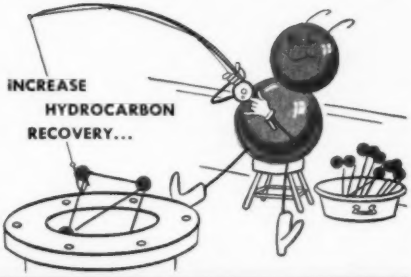
Consider the big Dodge 4-tonner, for example. Its husky, 154-hp. engine provides plenty of power for toughest jobs. Low fuel and maintenance bills are a certainty . . . thanks to Dodge extra-value features like 4-ring pistons and intake and exhaust valve seat inserts—plus twin carburetion and exhaust system. You can pack far bigger payloads without overloading, too, because of better weight distribution.

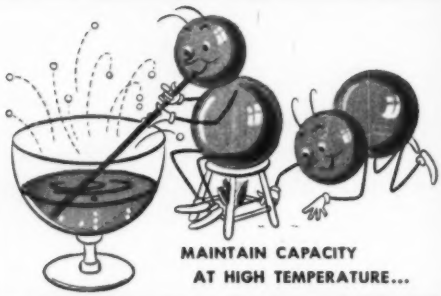
Chances are you'll want to gather in more facts for yourself on powerful Dodge "*Job-Rated*" trucks. If so, there's a cheerful chap close by who'll be happy to help solve your hauling problems. He's that neighborly Dodge dealer. And his door always stands open in welcome helpfulness.

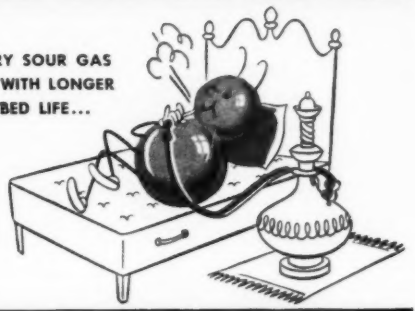
DODGE "Job-Rated" TRUCKS

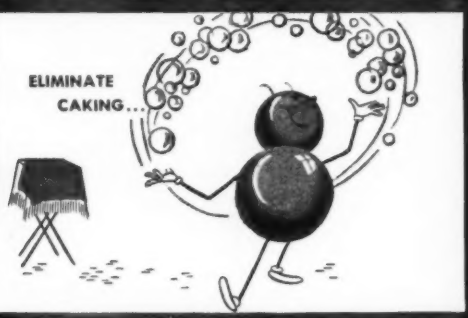
LOOK WHAT MR. SOVABEAD CAN DO IN YOUR DEHYDRATOR!

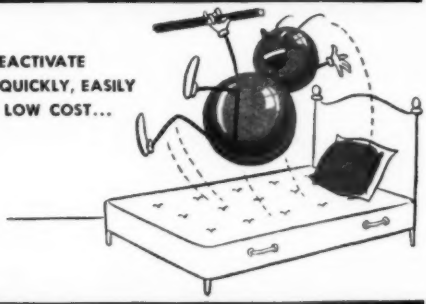












NOW... S/V Sovabead *is recommended* by most leading designers and manufacturers of solid-type natural gas dehydration units... *is used* by a majority of all operators of such units... *is performing satisfactorily* in hundreds of installations throughout the world!

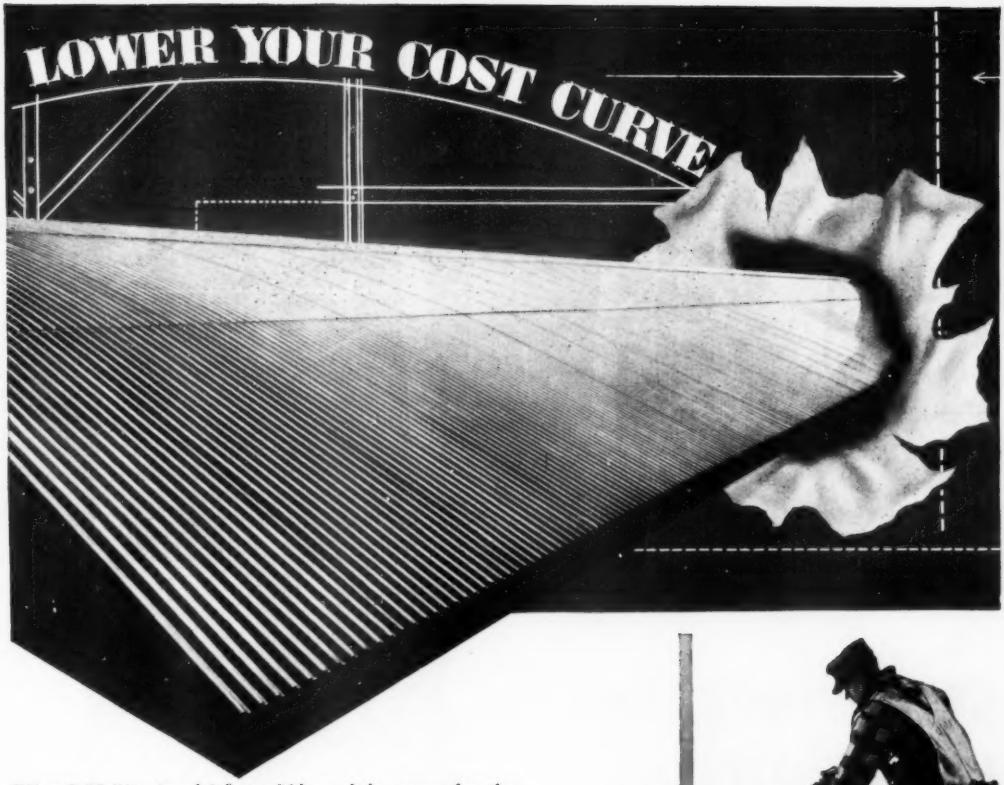
Let S/V Sovabead improve *your* dehydration operations. Call your Socony-Vacuum Representative today!

SOCONY-VACUUM

Process Products

Process Products
SOCONY-VACUUM

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates:
MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

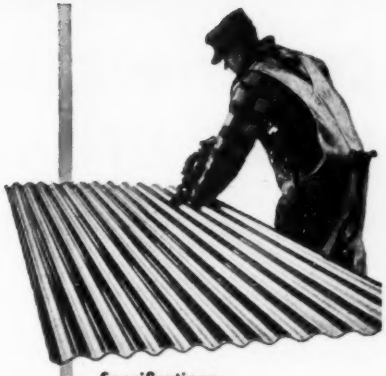


When S. M. Pistorio, of Arbutus, Md., needed a new roof on the curved wood trusses of his big warehouse, he found he could save on initial cost and lower his cost curve through the years with Reynolds *Lifetime* Aluminum Industrial Corrugated.

In this case, 11-foot sheets were used, curved at the site. For other curved roofs, Reynolds can supply curved sheets on request—minimum radius 5′. However, this special use only serves to demonstrate the versatility of aluminum industrial corrugated. On any type of roof it gives the owner the advantages of freedom from rust without protective painting, plus the radiant heat reflectivity that keeps interiors cooler in summer, warmer in winter.

The lighter weight of this roof (56 pounds per square) was especially important on this wood-trussed warehouse. On new buildings this factor can mean substantial savings on framing.

Call Reynolds for technical assistance and application details . . . offices in principal cities. For literature, write to Reynolds Metals Company, Building Products Division, 2023 South Ninth Street, Louisville 1, Kentucky.



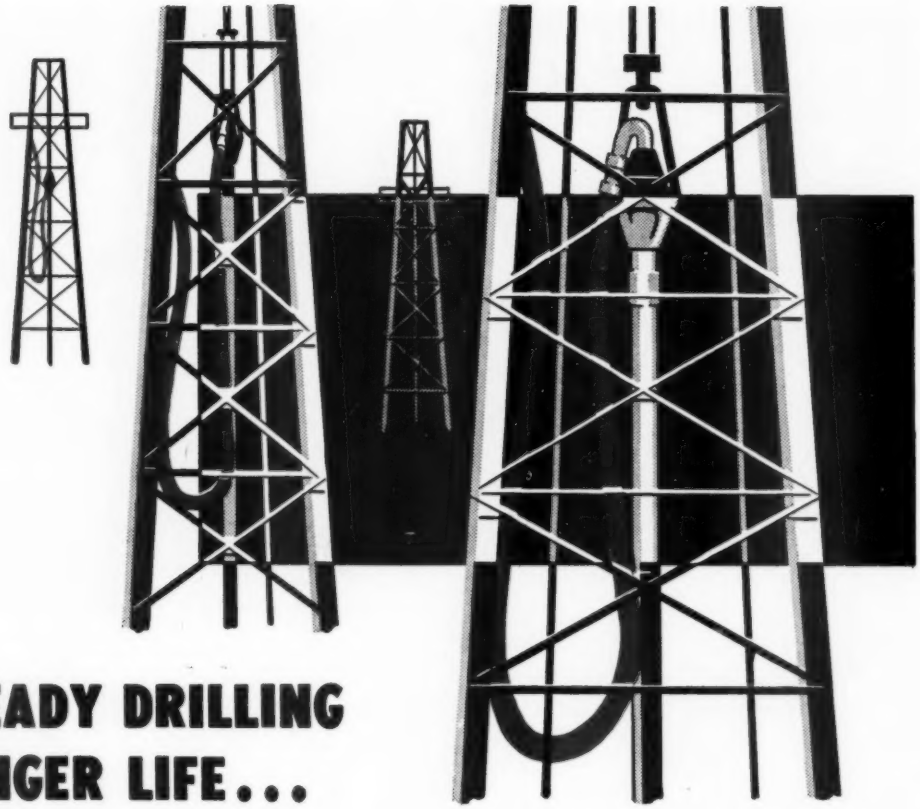
Specifications:

Thickness .032"
Corrugations 7/8" deep, 2-2/3" crown to crown
Uniform load support (roof) 80 p.s.f. on 4' purlin spacing
Uniform wind load capacity (siding) 20 p.s.f. on girt spacing up to 7'9"
Roofing width 35", coverage 32"
Lengths 5', 6', 7', 8', 9', 10', 11', 12'

Military demands for aluminum reduce supply, but Reynolds is rapidly expanding aluminum capacity. Rated orders receive priority handling.

REYNOLDS *Lifetime* ALUMINUM INDUSTRIAL CORRUGATED

Tune in every week . . . "The Kate Smith Evening Hour" on Television — NBC NETWORK



STEADY DRILLING LONGER LIFE...

RAY-MAN ROTARY HOSE

How could Rotary Hose be made safer, lighter and more flexible to handle? R/M engineers answered by developing one of the great improvements in the history of rotary hose . . . Ray-Man Rotary Hose • The Ray-Man method of winding high tensile steel wire strength members under precisioned tension permits rotary hose flexibility never before equaled. Strength and steadiness under high drilling pressures give greater safety and longer life than ever before • Other features, like the Lip-Lok seal in R/M's leak-proof, built-in coupling are described in Bulletin 6898. Your nearest National Supply Company representative can tell you how the new Ray-Man Rotary Hose speeds rig work and lowers drilling costs.

DISTRIBUTED BY NATIONAL SUPPLY COMPANY IN ALL PRINCIPAL OIL FIELDS

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

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Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls

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Controlled Quality

PIPE FITTINGS

reduce piping assembly time

Makeup goes smoother... with less chance for delay... on those piping systems where Ladish fittings are installed. Ladish Controlled Quality makes the difference. By exacting controls over materials and manufacturing processes... Controlled Quality assures uniform weldability through metallurgical integrity, fast assembly through dimensional accuracy and provides a real assurance of ultimate operating economy and complete dependability... reasons why it pays to specify LADISH.

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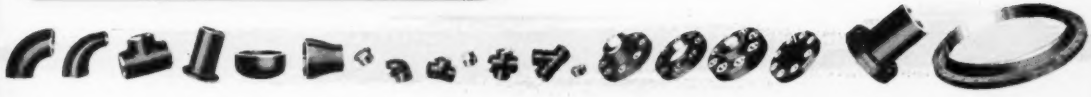
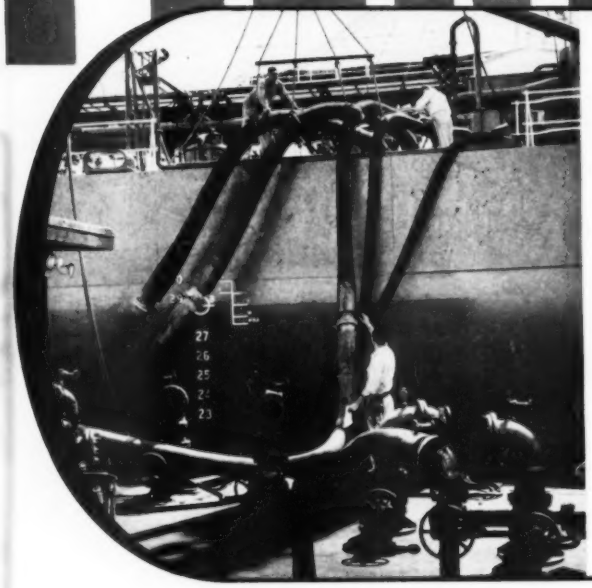


Industrial rubber products especially built for LONG SERVICE

PIONEER



Cooperation produced this exceptional oil hose

Standard of California tanker being loaded through Pioneer Oil Suction and Discharge Hose.

Most of America's best products spring from an interchange of ideas between the *user* and the *manufacturer*. Pioneer Oil Suction and Discharge Hose is the result of years of cooperation between engineering departments in the oil industry and our own laboratory and factories. This hose, as now used by Standard of California, for example, gives far longer service and helps speed tanker loading up to 20,000 barrels an hour!

Whether you want an industrial rubber product built to your specifications, or need the recommendation of experienced technicians, call on Pioneer Rubber Mills. Apply Pioneer's engineering experience and building facilities to the industrial rubber products you use, and you will get the *extra* service that Pioneer customers know so well. Just call your nearest Pioneer representative.

"How to LENGTHEN the life of industrial rubber goods"

This booklet gives you hundreds of down-to-earth suggestions on how to get better service from all kinds of industrial rubber products. You'll profit from the subject matter, and you'll be amused by the colorful illustrations. Whether you are yet a Pioneer customer or not, just drop a post card asking for "Lengthen Life" booklet. Address: Pioneer Rubber Mills, 345-353 Sacramento Street, San Francisco 11, California.

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Pioneering in rubber since 1888

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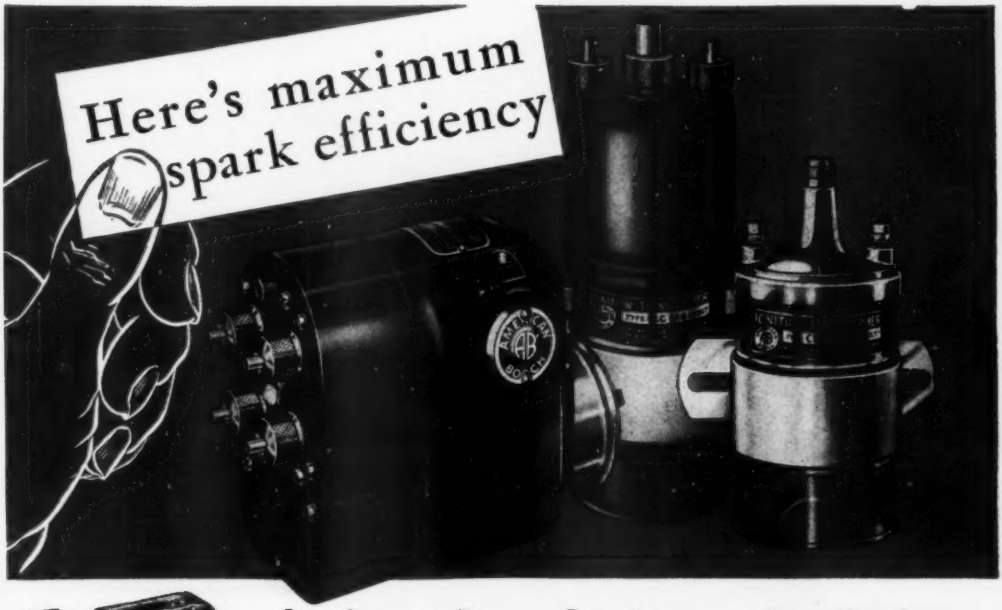
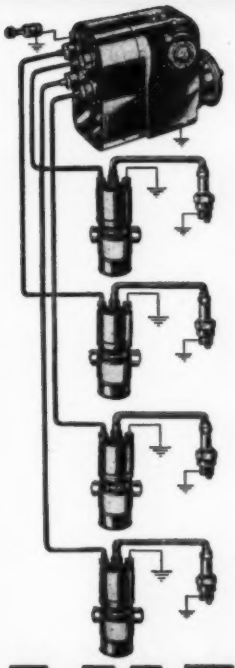




for Large Bore, Stationary Gas Engines

AMERICAN BOSCH

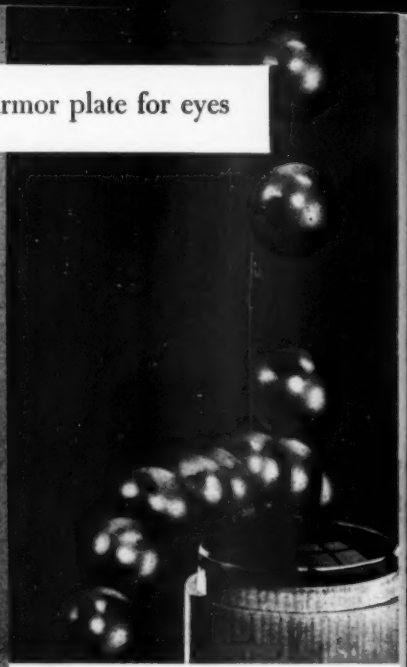
LOW TENSION MAGNETO IGNITION SYSTEM

The System comprises the American Bosch MRB Low Tension, shielded Magneto and individual High Tension Ignition Transformers mounted at each engine cylinder. (See 4 cyl. installation diagram at left). Low tension current, generated in the Magneto, is distributed through low tension leads to the Transformers. Here, the electrical energy is stepped-up to high voltage and conducted to the spark plugs by short cables—shielded if desired. The rugged, heavy-duty, high tension Transformers (as illustrated above) are available with or without shielding for use in the American Bosch System or other low tension systems employing magneto or battery ignition.

Energy losses and corona effects which occur with long high tension cables are eliminated. The possibility of fire and explosion hazard is minimized where engines operate in combustible vapors . . . radio and TV interference may be greatly reduced by complete shielding. These important advantages, combined with the outstanding electrical and mechanical features of the American Bosch Low Tension Magneto, offer maximum spark efficiency for engines operating under severest conditions. Write for the facts and we'll show you how you can get this peak performance and safer, continuous service with your present equipment. American Bosch Corporation, Springfield 7, Mass.

AMERICAN BOSCH

PROBLEM: Armor plate for eyes



ANSWER: If you dropped steel balls on *your* glasses, they'd shatter in dangerous splinters. AO safety-goggle lenses won't splinter. Scientists at American Optical devised a heat treatment that makes glass many times as strong, eyes safer.

PROBLEM: A hemoglobin laboratory for use at patient's bedside

ANSWER: Today, a physician need not send blood samples to a laboratory for hemoglobin analysis and delay diagnosis. Within 3 minutes, he can read the answer in the Hb-Meter. This meter is so fast that a patient's condition can be watched during treatment. Heart of the instrument is an accurately polished glass wedge, graded in color, against which the blood sample can be matched. The Hb-Meter is a creation of American Optical Company.

PROBLEM: To keep movie film from catching fire

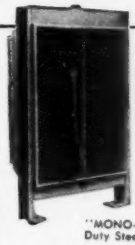
ANSWER: *Right*, film shielded by ordinary glass catches fire. *Left*, AO heat-absorbing glass prevents fire. This glass, developed for floods and projectors, absorbs 90% of heat from projected light, passes movie-film color in true values. Write us about your development problems. American Optical Company **63** Vision Park, Southbridge, Mass.

American Optical

YOUNG *All the Way!*

FROM WELL...

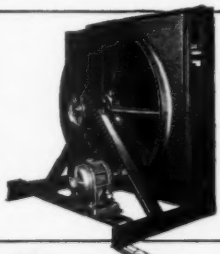
...TO GASOLINE PLANT



"MONO-WELD" Heavy-Duty Steel Radiator

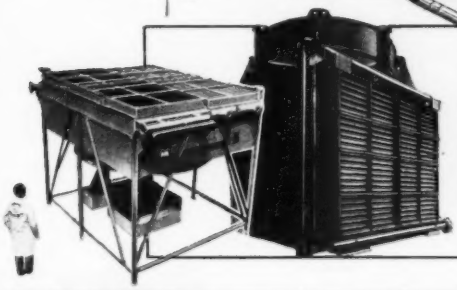
Fixed and Removable Tube and Bundle Heat Exchangers

"MONO-WELD" Radiators are available for cooling jacket water or for cooling jacket water and lube oil in a single unit. They are especially suitable for skid-mounted equipment and have welded steel tank and side member construction. Tube and bundle heat exchangers are particularly well adapted to applications where compactness is at a premium.



Heavy-Duty "FULL FLOW" and Standard Series Jacket Water Coolers

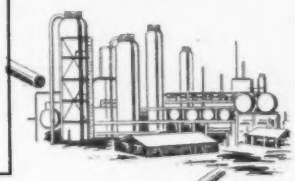
Remote locations require dependable, trouble-free cooling units, easy to maintain. Sturdily constructed "FULL FLOW" Jacket Water Coolers with removable sections (optional) make it possible to repair and replace easily. Accessories: motors, idlers, pumps, surge tanks, controls, shutters, etc.



Young "HC" (left) and "VAD" Vertical Air Discharge Cooling and Condensing Equipment

These large units can take care of your biggest cooling job. Versatility is a keynote —standard models provide for water, gas or oil cooling, steam or vapor condensing in any combination. Accessories available: motors, controls, shutters, gear boxes, etc.

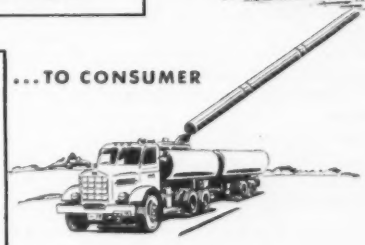
...TO REFINERY



Young Radiators For All Automotive Applications

Young serves every phase of the oil industry. Many manufacturers of oil transport and delivery equipment specify Young Radiators for gasoline and Diesel equipment. These radiators are carefully engineered for the specific job, as is the heat transfer equipment for the biggest oil field jobs.

...TO CONSUMER



1927 • 1952 25 YEARS OF PROGRESS

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY

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Factories at Racine, Wisconsin, and Mattoon, Illinois

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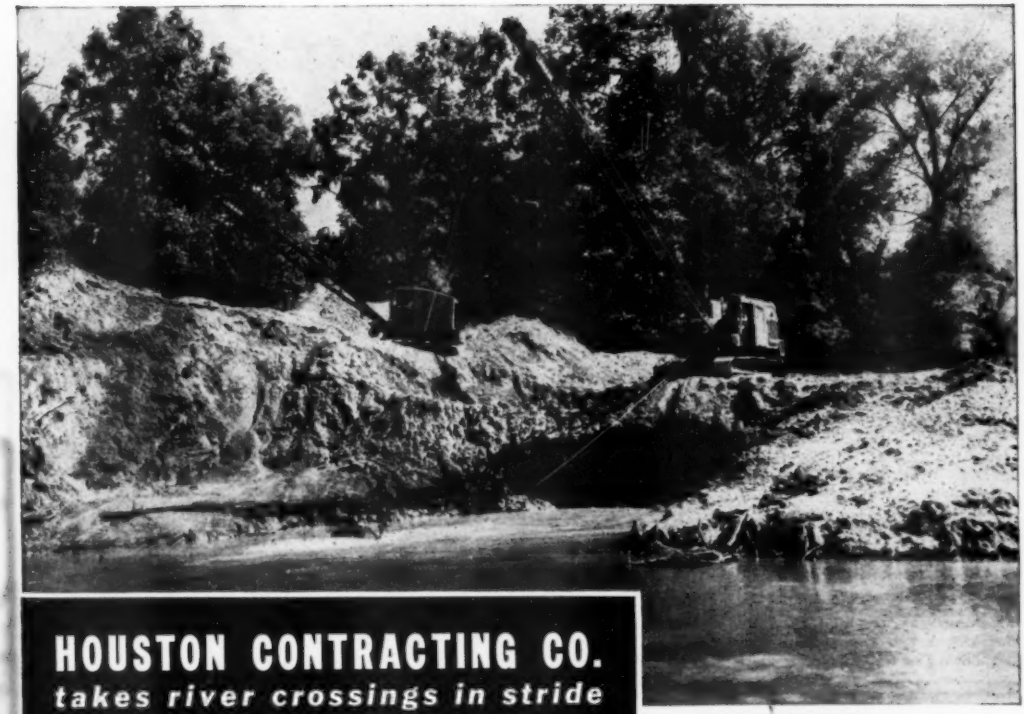
5043 Santa Fe Ave.

MUSKEGON: Harold J. Young
206 Montgomery Bldg.

Other Representatives in Principal Cities



HOUSTON CONTRACTING CO.
takes river crossings in stride
WITH LORAINS

Rivers don't stop Houston Contracting Co. from making speed on their pipeline jobs. They just move in their Lorains as they have on this river crossing near Bastrop, Louisiana. They have purchased 12 Lorains so far. Here they use a ¾-yard Lorain TL25-K and a 1-yard Lorain 50-K. Both have extra long crawlers ideally suited to dragline operation.

This is typically the way Lorains are serving pipeline contractors all over the world. If it's a river to be crossed, cross-country ditches to be dug or pipe to be strung, Lorains give cost-cutting, time-saving performance.

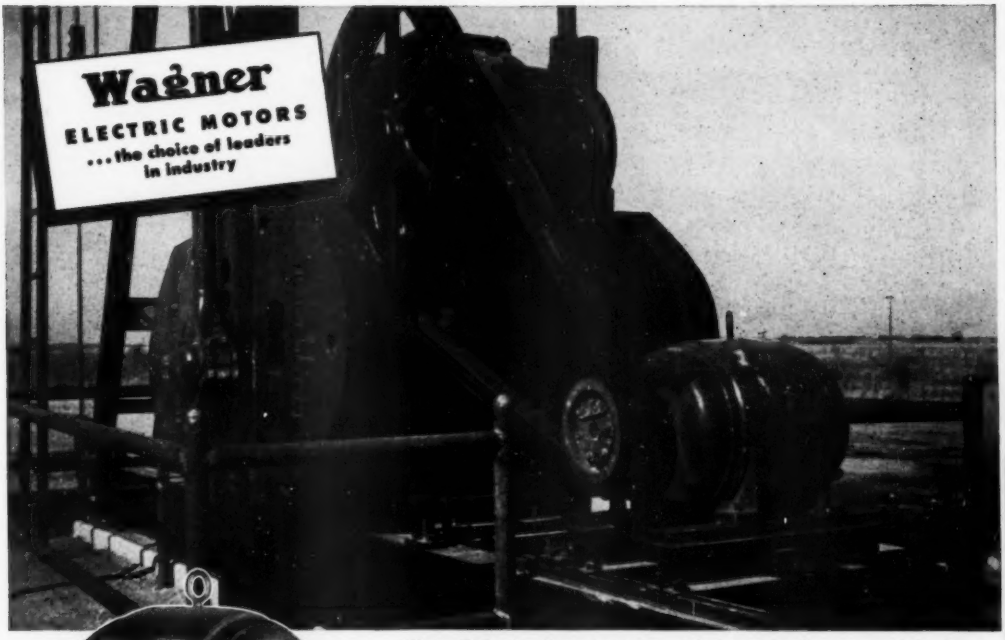
For example, Lorain Pipeliners, with hoe boom, and extra-wide crawlers are ideal for straddling ditches as they dig. Other Lorains, as clamshells, draglines, cranes and shovels — complete the Lorain pipeline package. There is a size, type and type of mounting to fit every pipeline need. See your Thew-Lorain Distributor and standardize on the line that fills *all* of your needs!

THE THEW SHOVEL CO., LORAIN, OHIO

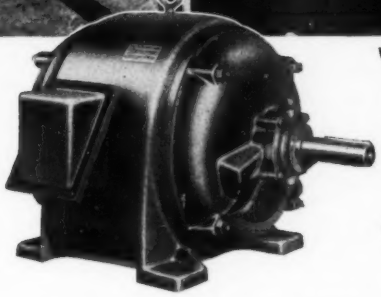
USE LORAIN MOTO-CRANES WHERE HIGH-SPEED MOBILITY IS A MUST

For high-speed mobility to cover all jobs along the right-of-way, high-speed, 30 m.p.h. Lorain Moto-Cranes are the answer. Moto-Cranes have multiple-tires for soft-ground flotation and tractive effort to travel rugged pipeline terrain. Available in crane capacities from 10-tons to the world's largest crane on rubber — 45 tons, with 2 or 3 axles and 4 or 6-wheel drive. Ask your Thew-Lorain Distributor for the Lorain Moto-Crane story!

THEW LORAIN PIPELINER



Wagner 25 hp oil well pumping motor, used by a large petroleum company in Texas.



Wagner

OIL WELL PUMPING MOTORS

combine the desirable characteristics of open motors with protection that assures long outdoor life

Wagner polyphase motors for oil well pumping are designed especially for outdoor service. These 40° C motors, with cast iron frames, have double-end ventilation. Sheet steel baffles inside the end-plates direct a cooling air flow around the stator iron and windings, while retarding the entrance of water. Ventilating openings are placed at the bottom of the frame so that any water that may enter the motor will immediately drain out. They have protective coverings to prevent the entrance of small animals and reptiles. Motor windings are specially treated for outdoor service and the cast iron conduit box is moisture-proof and dust tight. These motors are available in ratings through 75 hp and are built in two electrical types: high torque, normal slip; and high torque, high slip.

In addition to these drip-proof motors, the Wagner line includes splash-proof motors, protected against heavy driving rains. For applications requiring single-phase motors, Wagner can furnish capacitor-type motors with the same enclosures. The line also includes totally-enclosed fan-cooled motors in standard or explosion proof types for use in pumping stations and refineries.

Write for Bulletin MU-137 on Oil Well Pumping Motors and Bulletin MU-132 on Totally-Enclosed Cast Iron Motors. Thirty-two branch offices are ready to assist you in any motor application problem.

WAGNER ELECTRIC CORPORATION
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

® Wagner Electric Corporation EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

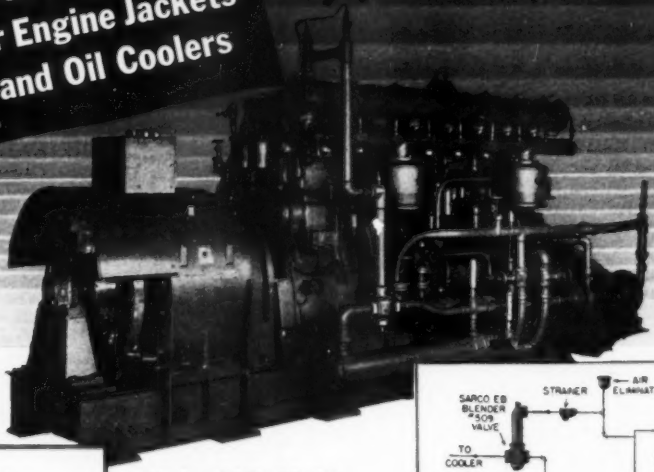
BRANCHES IN 32 PRINCIPAL CITIES

AE52-6

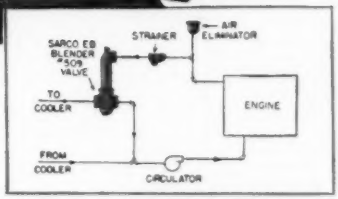
Constant Temperature...

of Cooling Water for Engine Jackets and Oil Coolers

Automatically



Atlas Imperial Diesel Engine, equipped with Sarco type EB blender to maintain constant jacket water temperature by re-circulating a varying portion of the cooling water.



Note the compact installation and simple piping. Also shown are the Sarco air vents and strainers which are necessary for efficient operation of the cooling system.

Sarco type EB Self-contained Water Blender, with built-in liquid-expansion thermostat for re-circulating control.

Sarco Blenders, by maintaining constant cooling water flow with controlled outlet temperature, insure rapid warm up, correct running temperatures and minimum temperature rise.

Simple, dependable Sarco controls prevent over-cooling or under-cooling, thus reducing wear on liners and rings, caused by cylinder condensation.

Smaller temperature fluctuations reduce stress and result in longer operating life and less maintenance.

Controlled Lube Oil temperature assures efficient lubrication.

Full information in Bulletin 702, sent free on request.

347

SARCO COMPANY, INC.

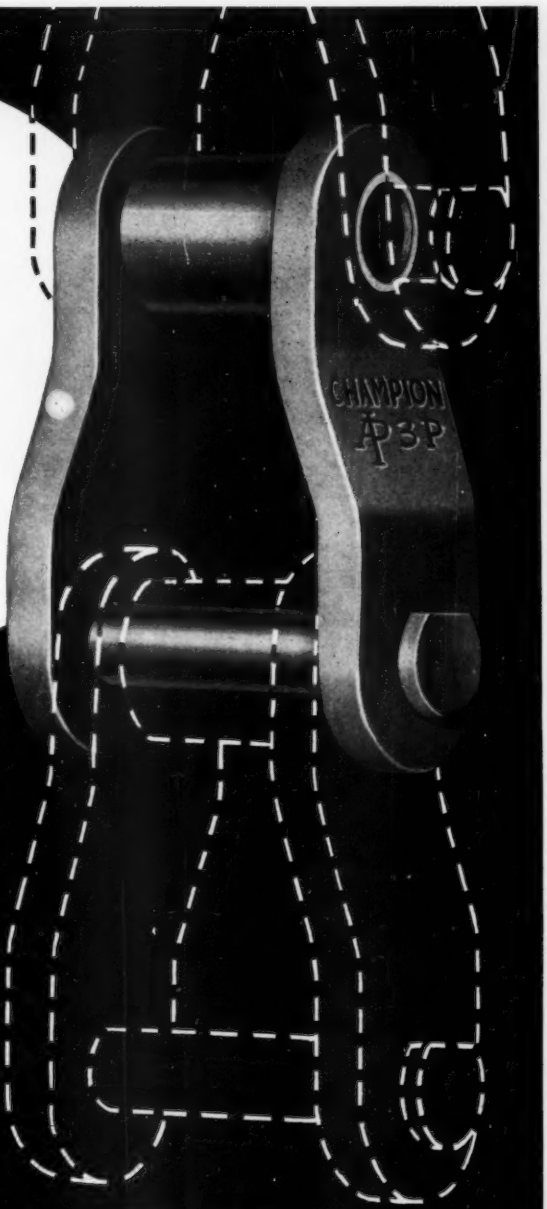
EMPIRE STATE BUILDING, NEW YORK 1, N. Y.

SARCO CANADA LTD., TORONTO 5, ONTARIO

REPRESENTED IN PRINCIPAL CITIES

why you're always right with

REX®



the REX UNIT LINK *for example..*

Assures longer chain life because motion is confined to the hardened wearing parts which are designed to take it.

For all the facts, write for Bulletin 51-8

REX API CHAINS

"for 40 years the greatest chains that ever hit the oil fields"

CHAIN BELT REX COMPANY®

Chain Belt COMPANY
OF MILWAUKEE

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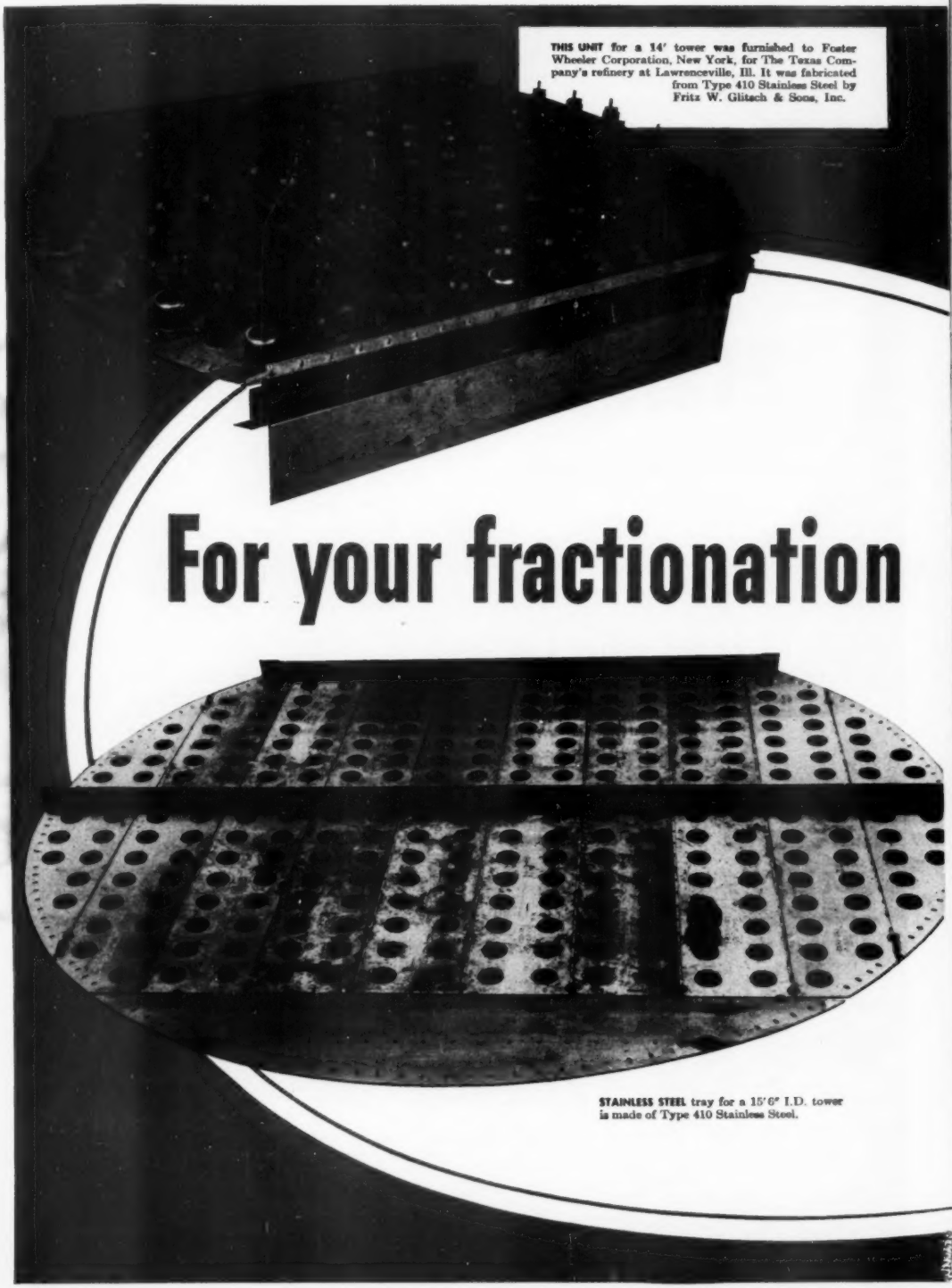
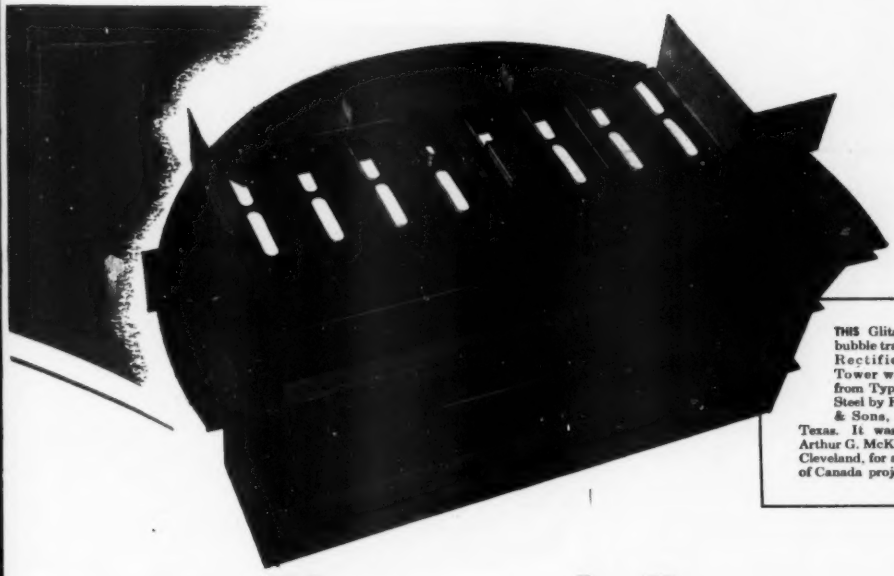


THIS UNIT for a 14' tower was furnished to Foster Wheeler Corporation, New York, for The Texas Company's refinery at Lawrenceville, Ill. It was fabricated from Type 410 Stainless Steel by Fritz W. Glitsch & Sons, Inc.

For your fractionation

STAINLESS STEEL tray for a 15'6" I.D. tower is made of Type 410 Stainless Steel.



THIS Glitsch trust-type bubble tray for a 6'6" I.D. Rectified Absorber Tower was fabricated from Type 410 Stainless Steel by Fritz W. Glitsch & Sons, Inc., Dallas, Texas. It was furnished to Arthur G. McKee & Company, Cleveland, for a Shell Oil Co. of Canada project.

tower "internals" take advantage of available U·S·S 12 Stainless Steel

(no CMP tickets needed)

USED in bubble caps, trays, weirs, risers, floors, trusses, major beams, uptakes and downcomers, U·S·S 12 (Type 410) Stainless Steel offers maximum corrosion resistance for your money. At the same time, use of this available straight-chromium grade helps conserve the supply of nickel-bearing Stainless Steels.

Type 410 Stainless Steel has a long history of satisfactory service in these types of applications. As long as ten years ago, more than 500 sets of bubble caps and trays fabricated from Type 410 were in use and giving highly satisfactory service.

One fabricator who has used Type 410 Stainless extensively since 1938 finds it has a life 6 to 7 times that of carbon steel under normal operating conditions.

This grade of Stainless Steel has excellent resistance to the corrosive conditions encountered in fractionation towers. And it resists the effect of temperatures encountered in this type of operation—as high as 1000°F.

Stainless Steel's dense, smooth surface prevents coking and fouling, thus permitting longer runs with less down time for cleaning. Its strength and toughness mean less breakage and less wasted tray area. Because of its high corrosion resistance and its formability, thinner sections can be used and one-piece bubble caps, risers, etc. can be made. Together, this makes possible longer life and lighter weight units.

U·S·S 12 Stainless Steel—a service-tested material—will give you unmatched performance in these internal parts. Specify it to your fabricator; he needs no CMP tickets for any form of this material.

UNITED STATES STEEL COMPANY, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

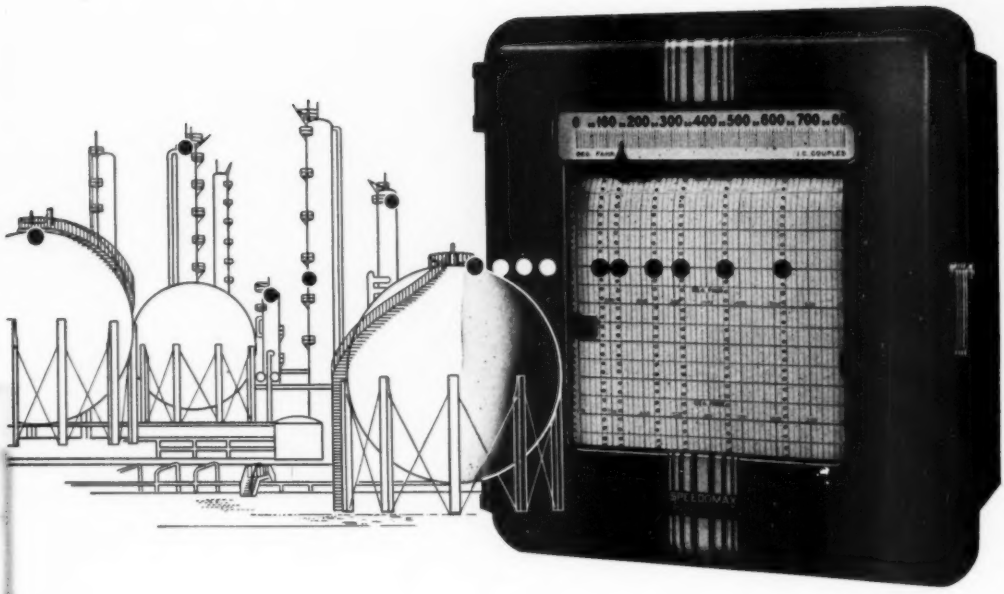
U·S·S STAINLESS STEEL

USS

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

8-385

UNITED STATES STEEL



A new temperature Fact every 2 sec!

Today, when many refinery operations may need temperature facts within seconds instead of minutes, the Speedomax story is worth knowing:

For a Speedomax Multiple-point instrument's record-printing "wheel" darts from temperature to temperature in just 2 seconds per point! Thus, if there are, say, 15 fairly important temperatures on a single refinery unit, each one can actually come up and be recorded as often as twice per minute, automatically and continuously.

Two extra checks for vital temps

But suppose a few points require even closer watching, or more frequent recording? Speedomax handles them, too, in either of two ways:

First, they can be recorded more frequently than the other points, in such a sequence as 1, 2, 1, 3, 1, 4, etc.

Second, the vital points can be recorded in greater detail than the other points. This is done by giving the instrument an additional range which is used only with the pre-selected points. This range puts far fewer degrees-per-inch across the instrument's scale; it thus "spreads" the reading for detail.

Ability to measure temperature from any source and across either wide ranges or the new narrow ranges is another L&N specialty. Selection among thermocouples, Thermohms and Rayotubes will determine the correct sensing element. Selection among various recorder components will put the information on paper in the desired form.

160 temps on one instrument

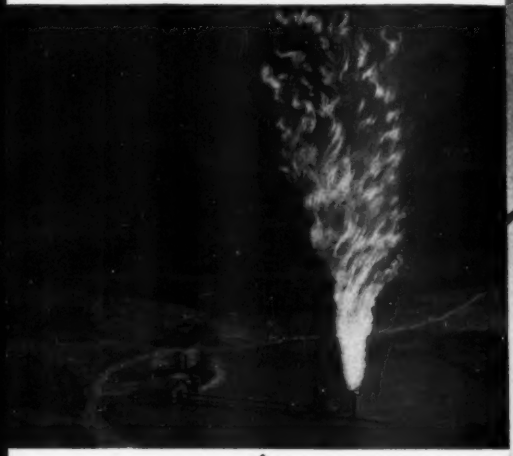
For these and many more features . . . for instance, 160-point models . . . credit Speedomax's refined, stable, dependable construction, both electrical and mechanical. Too, Speedomax is not affected by vibration; never needs levelling up; can measure many quantities besides temperature.

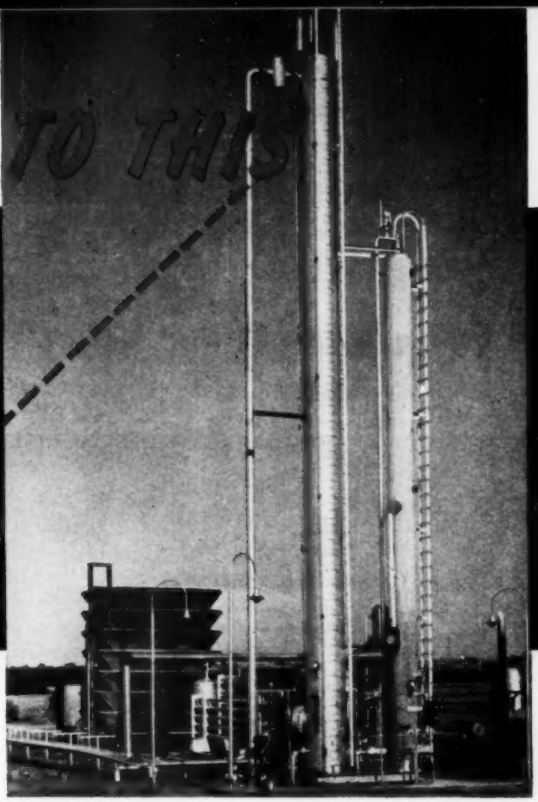
Any L&N office, including 4959 Stenton Ave., Phila. 44, Pa., will send the Speedomax story on request.

LEEDS NORTHRUP

Jrl. Ad. ND46-700(2)

FROM THIS... TO THIS





with a BLAW-KNOX PACKAGED GASOLINE PLANT

In self interest and sometimes in self defense it is advantageous to recover small amounts of casing-head or stock-tank vapors. For this specific purpose Chemical Plants Division of Blaw-Knox Construction Company offers a packaged plant featuring:

1. **The compactness and economy of "packaged" design and construction.**
2. **Skid mounting of the major plant units gives the plant better than 80% salvage value.**
3. **The elimination of steam for operating.**
4. **Relatively low labor requirements.**
5. **Gas operated instrumentation (no air required).**

Chemical Plants Division offers you the combined technical know-how of 300 engineers experienced in gasoline plant and refinery design. In this group are also a large number of experienced operational engineers, fully familiar with the problems involved in this type of plant. Our Southwest Division, located in Tulsa is specially fitted to serve the natural gasoline and petroleum industry. We invite your telephone call at Tulsa 5-8221, for more detailed information and will be glad to prepare proposals for your particular needs.

Advantages of this profitable plant are described in "Package Gasoline Plant Processing 5,000,000 cu. ft. of Gas Daily" by T. P. Cook, Chief Process Engineer of the Southwest Division of Blaw-Knox. Write for a copy.

CHEMICAL PLANTS DIVISION

BLAW-KNOX CONSTRUCTION COMPANY

TULSA 1 • PITTSBURGH 30 • NEW YORK 17 • PHILADELPHIA 3

CHICAGO 3 • BIRMINGHAM 3 • WASHINGTON 5, D.C.

CHEMICAL PLANTS DIVISION

Blaw-Knox Construction Co., Tulsa 1, Oklahoma

Please send reprint on Packaged Gasoline Plant to:

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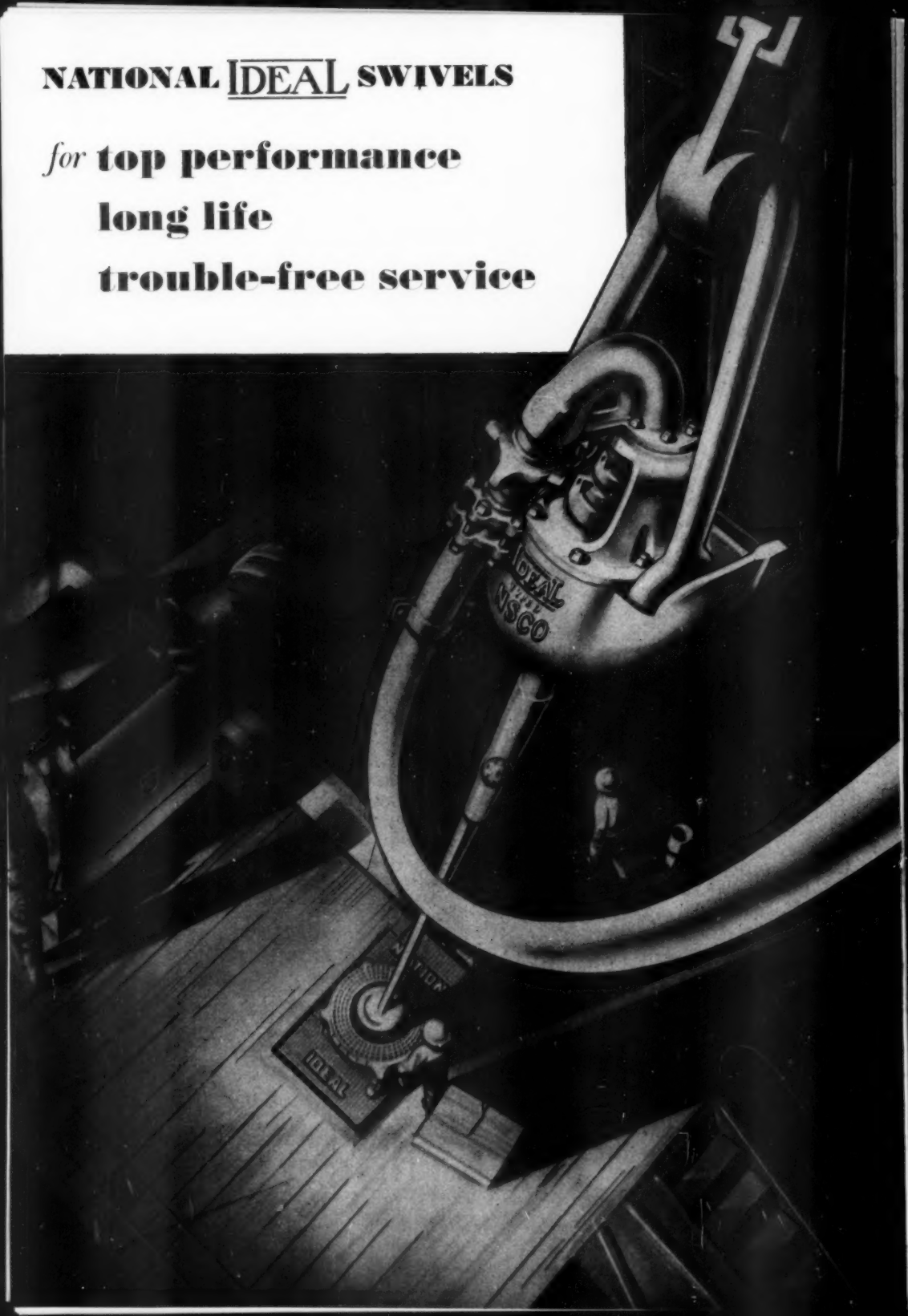
ADDRESS _____

NATIONAL IDEAL SWIVELS

for **top performance**
long life
trouble-free service



NATIONAL'S single objective for complete-line perfection has produced thirteen different types of Ideal Swivels, with nominal unit ratings of 55 tons to 250 tons. Ideal Swivels are *proved* by intensive load and speed tests on National's special shop-testing equipment. Main bearing performance is charted, and each swivel is accurately rated to meet the exacting standards established by National Supply for Ideal Swivels.

All Ideal Swivels contain these stand-out construction features:

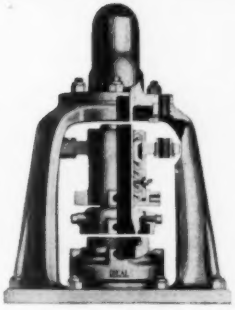
★ **Radial Bearings above and below the main bearings assure perfect sleeve alignment.**

★ **Alloy Steel Couplings heat treated and electroplated to minimize corrosion.**

★ **Automatically Induced Oil Circulation during operation.**

★ **And undoubtedly the most outstanding construction feature is the main bearing —the *heart* of the swivel. Precision built from high-quality steel—designed to take extreme loads and wide ranges of speeds, this bearing gives every Ideal Swivel longest life expectancy under normal operating conditions.**

The drilling equipment specialist at your local National Supply Store will be glad to help you select the *Ideal* Swivel for your specific need. Bulletins are available covering the loads and speeds at which you operate—write for them.



One of National's unique developments is the quick-change Wash Pipe Packing Box for deep drilling Ideal Swivels (types R, RC, MU, and MUC). The ultra simplicity of this unit makes it possible to replace the entire assembly quickly and efficiently under emergency conditions.

THE NATIONAL SUPPLY COMPANY

General Sales Offices: Toledo, Ohio

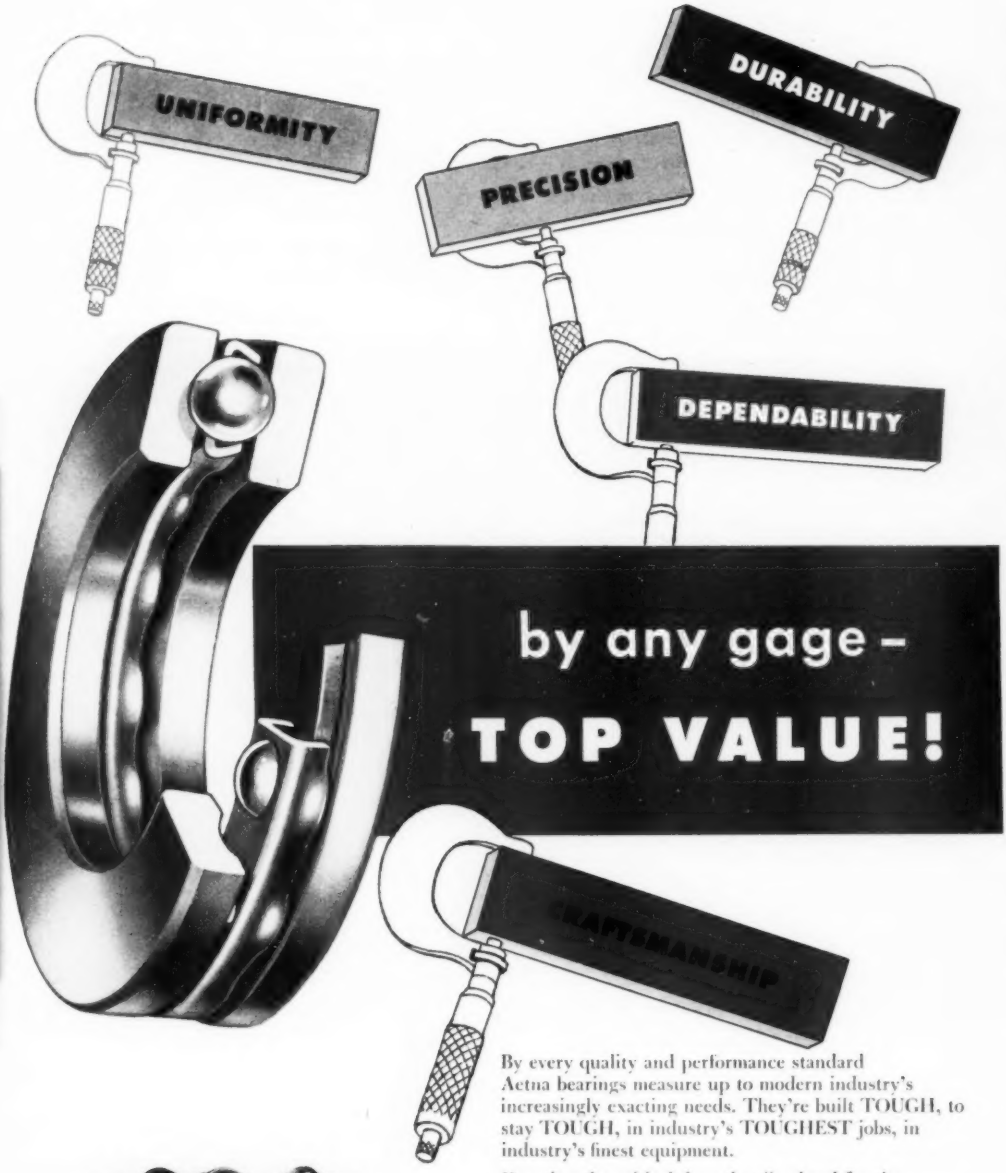
DIVISION OFFICES: Casper; Ft. Worth; Houston; Pittsburgh; Tulsa; Torrance

CANADA: The National Supply Company, Limited, 702 Barron Building, 610 Eighth Avenue, West, Calgary, Alberta

EXPORT: 600 Fifth Avenue, New York 20, New York, U.S.A.; River Plate House, 12 South Place, London, E.C.2

NATIONAL BLUE PRODUCTS

NATIONAL OIL FIELD MACHINERY AND EQUIPMENT · SPANG STEEL PIPE · SUPERIOR & ATLAS ENGINES

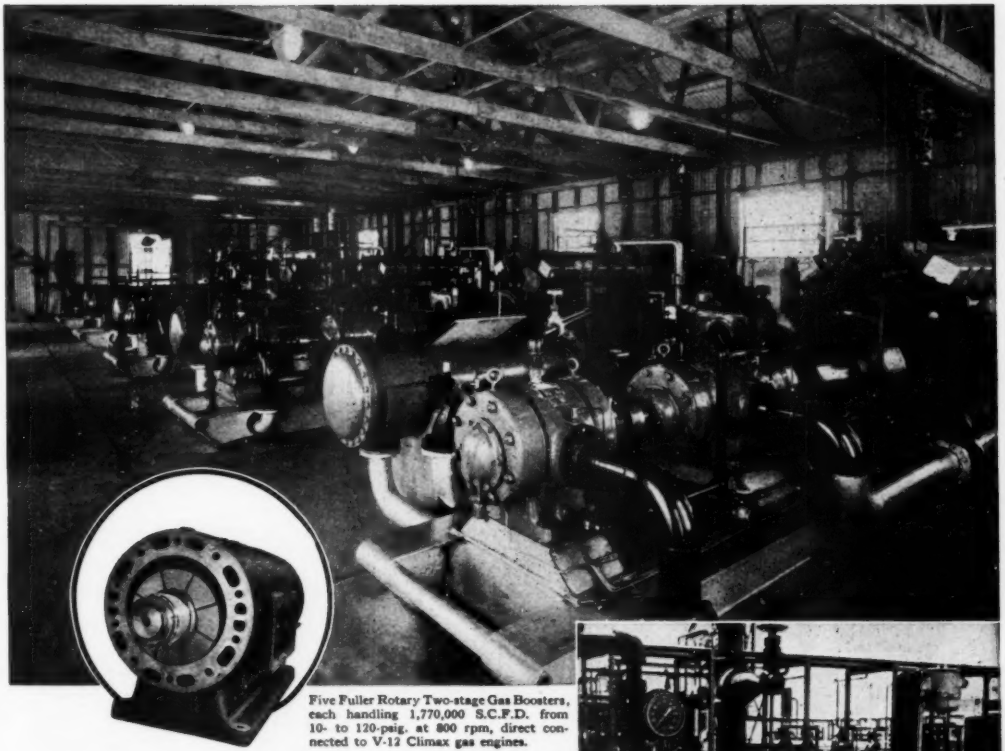


By every quality and performance standard Aetna bearings measure up to modern industry's increasingly exacting needs. They're built TOUGH, to stay TOUGH, in industry's TOUGHEST jobs, in industry's finest equipment.

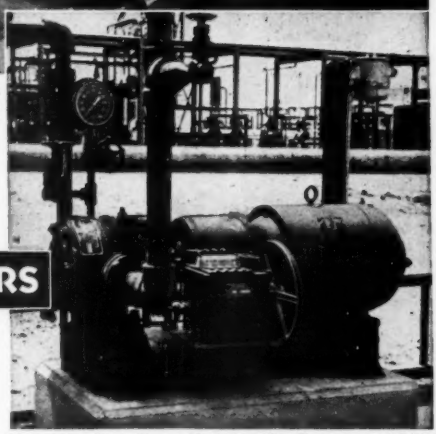
Knowing the critical days that lie ahead for the equipment YOU make or use, it stands to reason you'll place more emphasis on the quality of the bearings you buy and the anti-friction engineering service you employ. In that direction we have no better sales talk to offer than the fact that we serve the Nation's foremost manufacturers—that 80% of our business comes from firms we have served for 20 or more of our 36 years.

Standard and Special Ball Thrust Bearings • Angular Contact Ball Bearings • Special Roller Bearings • Ball Retainers • Hardened and Ground Washers • Sleeves • Bushings.

AETNA BALL AND ROLLER BEARING COMPANY
4600 Schubert Avenue • Chicago 39, Illinois



Five Fuller Rotary Two-stage Gas Boosters, each handling 1,770,000 S.C.F.D. from 10- to 120-psig. at 800 rpm, direct connected to V-12 Climax gas engines.



Motor-driven Fuller Rotary Single-stage Gas Booster . . . 570,000 S.C.F.D. at 1160 rpm.

Dependable Gas Boosting with FULLER ROTARY COMPRESSORS

For extra gas boosting capacity to plant or trunk level, Fuller Rotary Compressors can be spotted anywhere along gathering or supply lines where they operate efficiently, under the most adverse conditions, without constant supervision.

Fuller Compressors require little maintenance because only the rotor, blades and bearings move. No valves to leak or seats to grind. The blades automatically compensate for wear. Pulsation and vibration are reduced to a minimum. A simplified, direct drive eliminates power transmission losses. Call a Fuller engineer for the most efficient, economical way to boost pressure.

Fuller Compressors are available in a range of cylinders up to 3300 c.f.m. (at atmospheric intake) at normal speeds, with a reasonable variation in speed range; motor, engine or turbine drive.

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
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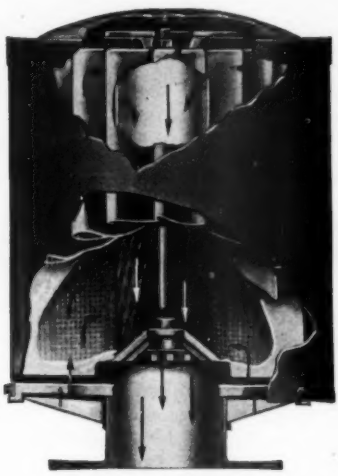
They give us positive protection . . . They won't need regularly scheduled maintenance . . . They're easy to clean on the job . . . Efficient over a wide range of loads . . . They're not affected by temperature change . . . There's no oil carry-over

OUR EQUIPMENT WILL LAST LONGER!"



MODEL D
Intake Filter

Industrial engineers everywhere know that Staynew's *Positive Protection* lengthens equipment life. From compressors to generators . . . from blowers to internal combustion engines, Staynew Intake Filters stop dust and dirt from entering through air intakes, causing carbon accumulation and needless wear. And Staynew Filters frequently operate two or more years *without maintenance.* When cleaning is indicated, a brush or simple vacuum cleaning insert is all you need. Specify Staynew and increase productive time.

Write for Complete Booklet on Staynew Intake Filters.

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DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

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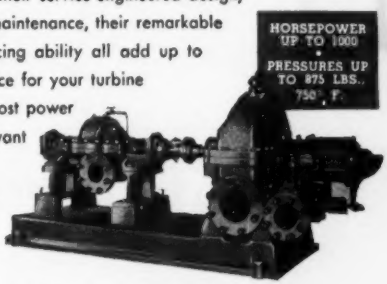
ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

DEAN HILL STEAM TURBINES

are single stage, double impact type for low steam consumption. Specifically designed for operation at medium steam pressures and temperatures, DH Turbines have all the advantages available under these conditions, including excellent water rates. Get the full details and complete specifications. Write today.

POWERFUL "PENNY PINCHER"

Power a-plenty at a penny-pinching cost! That's how DEAN HILL STEAM TURBINES operate. Their super rugged construction, their service-engineered design, their low maintenance, their remarkable power-producing ability all add up to far more service for your turbine dollar. If it's low cost power you want . . . you want DEAN HILL STEAM TURBINES.



DEAN DH HILL PUMP COMPANY

Pump and Turbine Engineers Since 1895

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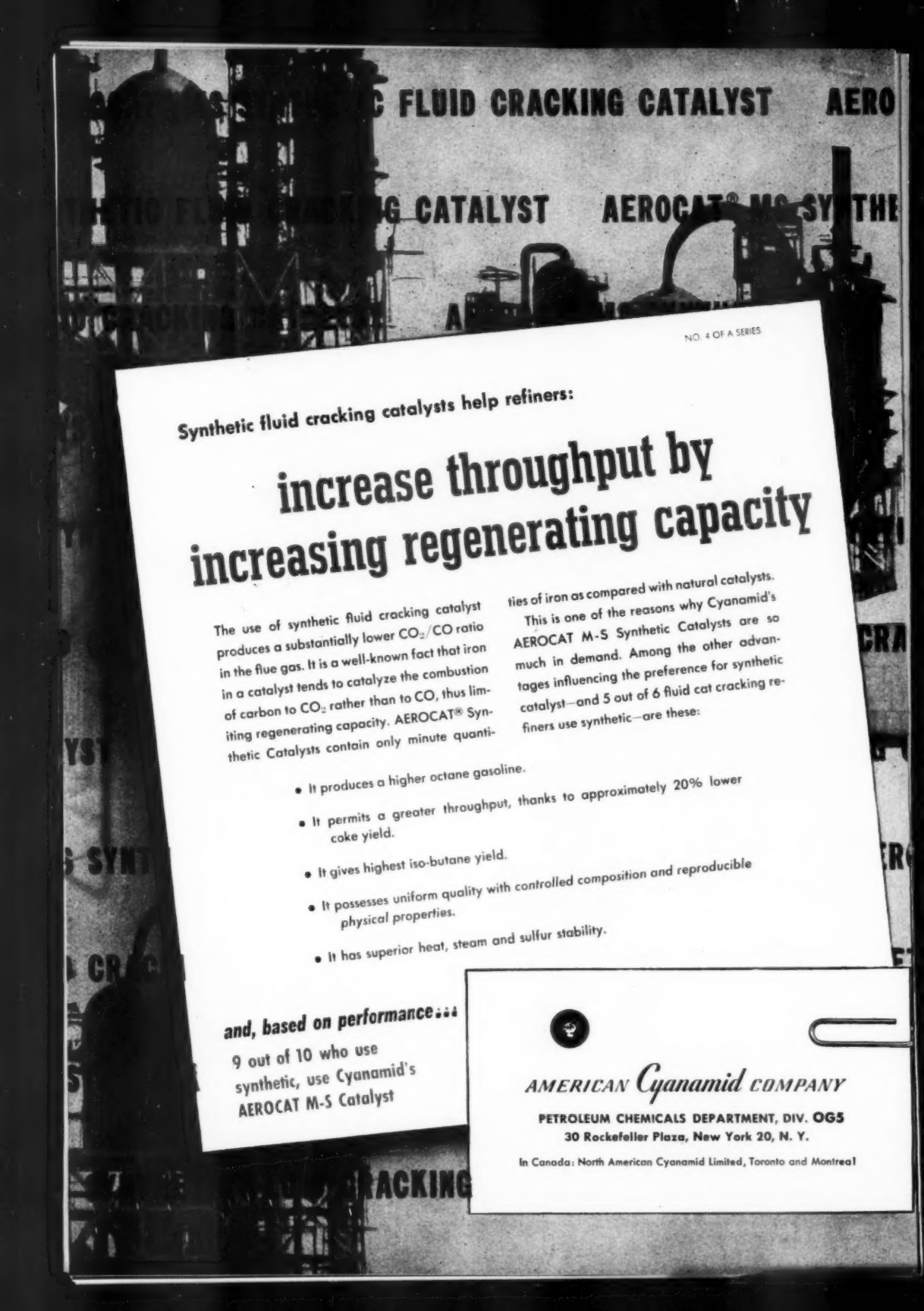
FLUID CRACKING CATALYST AERO
CATALYST AEROCAT
NO. 4 OF A SERIES
Synthetic fluid cracking catalysts help refiners:
increase throughput by increasing regenerating capacity
The use of synthetic fluid cracking catalyst produces a substantially lower CO_2/CO ratio in the flue gas. It is a well-known fact that iron in a catalyst tends to catalyze the combustion of carbon to CO_2 rather than to CO, thus limiting regenerating capacity. AEROCAT® Synthetic Catalysts contain only minute quantities of iron as compared with natural catalysts.
This is one of the reasons why Cyanamid's AEROCAT M-S Synthetic Catalysts are so much in demand. Among the other advantages influencing the preference for synthetic catalyst—and 5 out of 6 fluid cat cracking refiners use synthetic—are these:
• It produces a higher octane gasoline.
• It permits a greater throughput, thanks to approximately 20% lower coke yield.
• It gives highest iso-butane yield.
• It possesses uniform quality with controlled composition and reproducible physical properties.
• It has superior heat, steam and sulfur stability.
and, based on performance...
9 out of 10 who use synthetic, use Cyanamid's AEROCAT M-S Catalyst
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PETROLEUM CHEMICALS DEPARTMENT, DIV. OG5
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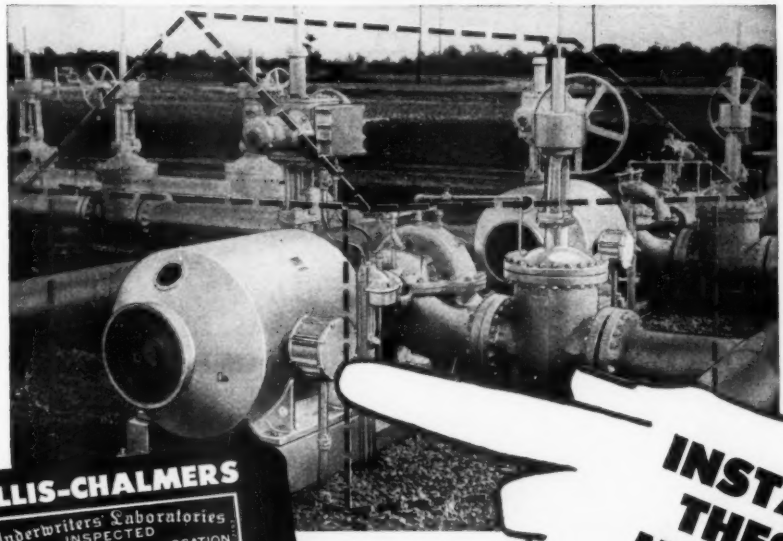
No building to buy!



INSTALL THESE MOTORS OUTDOORS

YOU CAN ELIMINATE costly building on many different kinds of installations by using Allis-Chalmers Tube-type, Explosion-proof Motors and installing them outdoors. The motors shown here operate outdoors all year round at a midwestern pipe line booster station. Rain, snow, dirt, the weather's worst conditions, do not affect their dependable operation. And the same kind of savings can be made in hundreds of other applications in the field, on pipe lines and in the refinery.

Self-Cleaning Feature Saves Maintenance

The cooling system in this unique motor is practically self-cleaning. Cooling air is blown through straight, smooth tubes at sufficient velocity to clean out ordinary dirt, even after long shutdowns. There are no corners or pockets to trap dirt or moisture. If sticky dirt clings, a ramrod will clean the tubes in seconds without stopping the motor.

On any type of duty, indoors or out, Allis-Chalmers Tube-type, Explosion-proof Motors reduce maintenance by keeping themselves clean. Get full details from your Allis-Chalmers Authorized Distributor or District Office. Or write Allis-Chalmers, Milwaukee 1, Wis., asking for bulletin 51B7149.

A-3696

***Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.**

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Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

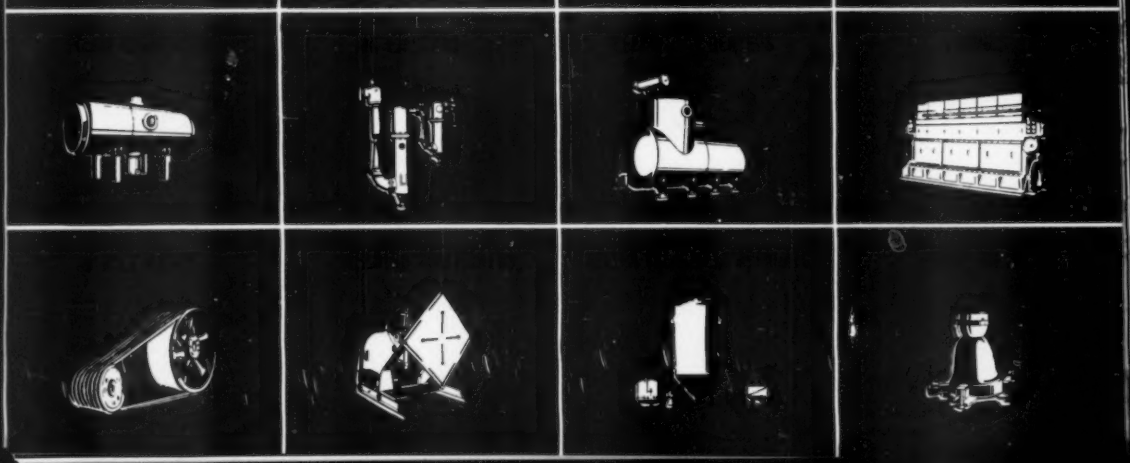
Why has the World's Leading Manufacturer of Pumps taken the "Pump" out of its name?

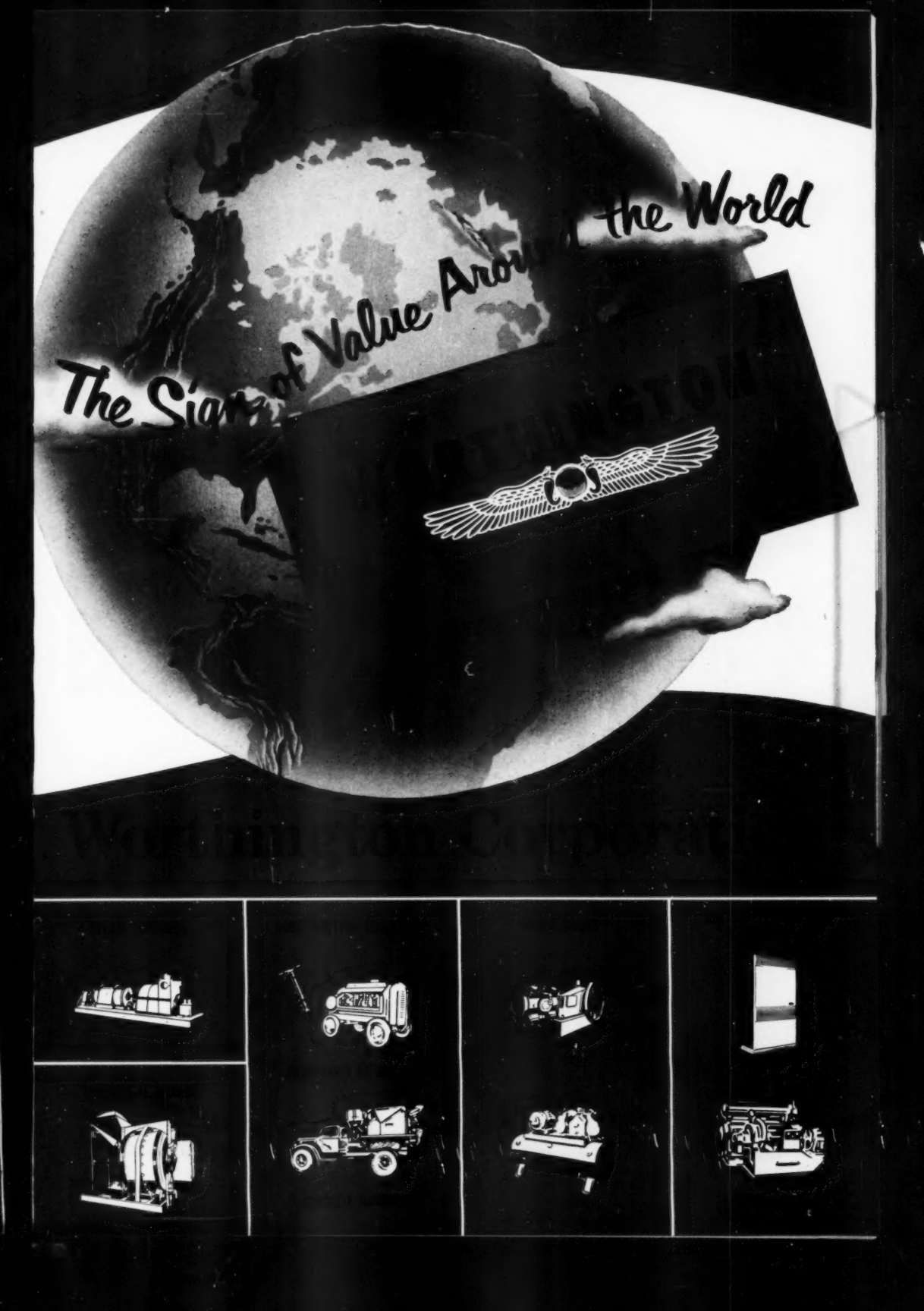
For 111 years "Worthington" has meant *pumps* to industry everywhere. During this period, Worthington has developed a position of leadership in many related fields. Fourteen major product lines including pumps are manufactured in 21 plants throughout the world.

To those we serve, Worthington is *more than pumps*. That's why the world's leading manufacturer of pumps has changed its name from

WORTHINGTON PUMP AND MACHINERY CORPORATION

2.2




The Sign of Value Around the World

TRACTION You can trust

4-wheel drive PAYLOADER®

It takes traction in all kinds of going to get jobs done on schedule — traction you can rely on the year 'round . . . pneumatic tire traction that can travel on highways as well as on ground, snow, sand and mud . . . that handles big loads quickly, easily and surely.

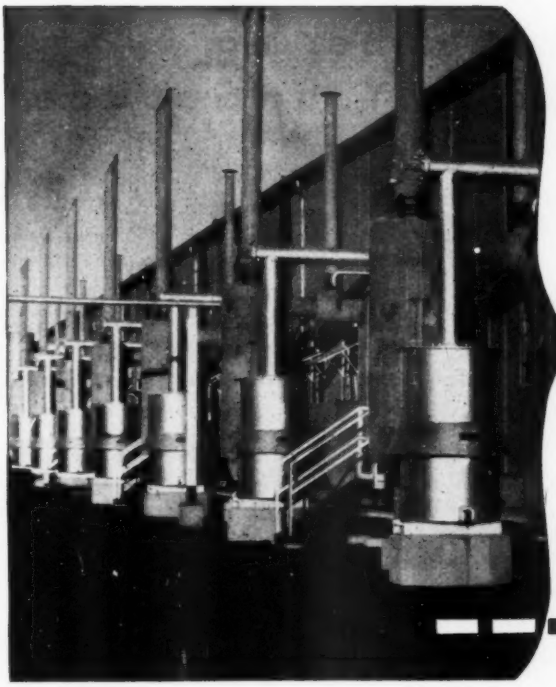
Yes, contractors, drillers and oil companies are amazed at the all-around traction of this unusual 1½ yd. tractor-shovel and its ability to do so many jobs well. It digs slush pits, builds fire walls, maintains roads, bulldozes, loads dirt and materials, grades drilling sites. It does crane work, carries tools and supplies . . . does drawbar and pushing work.

Operators like its ease of operation, thanks to power-boosted steering, fingertip hydraulic control, the quick, easy shift between the four forward speeds and four reverse speeds. Once you see the Model HM "PAYLOADER" in action you'll want one too, so see your "PAYLOADER" Distributor or write The Frank G. Hough Co., 749 Sunnyside Avenue, Libertyville, Illinois.

WRITE for catalog on the 1½ yd. Model HM or the six other "PAYLOADER" sizes down to 12 cu. ft. bucket capacity.

PAYLOADER®

SAY "HUFF"



Every Cycoil is a SAVINGS BANK

Freedom from Dust-Damage Cuts Repairs and Costly "Down Time"

Each of the Cycoil Oil Bath Air Cleaners serving these eight 1200 hp engines actually "doubles" as a savings bank. The dust it collects represents hard cash that *won't* be spent on engine repairs and resulting shutdowns due to dust-damage.

Here's why you are assured of tangible, continuous savings over the years with Cycoil. This air cleaner is designed to operate at 100% efficiency in the removal of damaging dust. Over 90% of the total fine-dust content of the air is trapped by Cycoil oil-bath action even before reaching the filter pads. Positive oil circulation for continuous self-cleaning action, plus the added filtration to be had in the filter pads, results in approximately 100% clean air.

Write for Bulletin No. 130. It gives you the detailed story of Cycoil's proven design and high efficiency.

Today's Best Buy is Better Air!

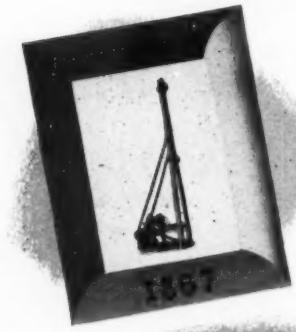
AAF

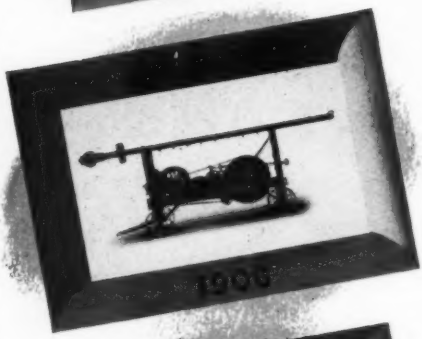
American Air Filter

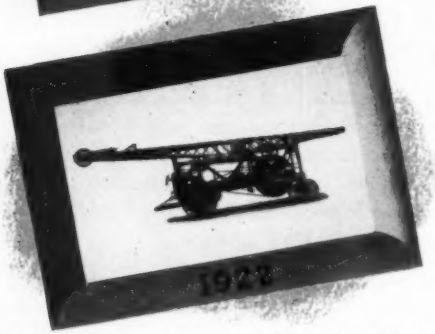
COMPANY, INC.

444 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

DATES Worth Remembering When Choosing Your Spudder







1859 — Col. E. L. Drake drills first producing oil well in America near Titusville, Pa.

1867 Henry Kelly builds original portable drilling rig, forerunner of the modern Bucyrus-Erie spudder.

1895 — First band wheel drilling rig introduced.

1906 — Single-cylinder gasoline engine developed for operating drilling rigs.

1908 — Compensating band wheel clutch perfected.

1916 — Wire line derrick introduced.

1922— Armstrong line of drills changed from wood to steel construction.

1922 — Multiple-cylinder engine adopted for powering drill rigs.

1929 — Rubber shock absorber in the derrick head developed.

1938 — Large scale oil development starts in Illinois. Bucyrus-Erie 24-L spudder developed to meet the demands for highly mobile cable tool drilling and servicing machines.

1940 — Bucyrus-Erie answers field requests for a spudder capable of deeper drilling by introducing the 36-L, for drilling to 3,500 feet and servicing to 4,000 feet.

1941 — Automatic spooling device for bull reel developed and patented by Bucyrus-Erie.

1945 — The 28-L spudder, designed for moderate-depth drilling and servicing operations, is introduced by Bucyrus-Erie.

1945 — Bucyrus-Erie's 48-L spudder is introduced, for drilling to 6,000 feet, servicing to 7,000 feet.

94551

BUCYRUS-ERIE'S background in developing today's outstanding spudders dates back to "Kelly's Cam and Treadle Well Digger", the first portable drilling rig, and Kelly, Morgan & Company, organized in 1868 to market the machine commercially. When Bucyrus-Erie took over manufacture of the Armstrong line of drills in 1932, it acquired a business that was a direct lineal descendant of Kelly's original firm.

Yes, time has brought about many changes in Bucyrus-Erie drills in their 84 years of existence! From 1867 to the present day they have kept ahead of the field through a continued, thorough study of your drilling requirements, through advanced engineering, and through the use of quality-proven materials in the manufacturing process. Remember these important facts when you choose your next spudder . . . remember the famous Bucyrus-Erie line. Four models to choose from — 24-L, 28-L, 36-L and 48-L.

Sludge . . . a water formed sedimentary deposit which may include all suspended solids in the water. Sludge usually does not retain its physical strength when removed, but it may bake in place and become hard and adherent . . . (Ref. ASTM D 887, D 933).

Use DREW POWER CHEMICALS

Tube failure, expense and inconvenience . . . even plant shut down . . . frequently results from baked-on sludge. Sludge often resembles scale and frequently causes the same troubles. It's the function of every good boiler water treatment to prevent the adherence of sludge as well as scale.

So we say, "Draw a Bead on Boiler Sludge, Mr. Engineer." Call in the Drew engineer. The water samples and operating data that he obtains in your plant will be thoroughly analyzed in the Drew Laboratories, and you'll be given specific recommendations for corrective Drew treatment. Furthermore, your Drew engineer will give you frequent and continuous help in your plant.

Thorough investigation, proper treatment, and frequent service have made Drew one of America's fastest growing water treatment companies. Consult the nearest Drew engineer or write for information.

Power Chemicals Division

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

SAN FRANCISCO CHICAGO PHILADELPHIA BOSTON DALLAS

Service throughout the United States, Canada and South America

DREW PRODUCTS

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.

EXTRA THICKNESS* in critical areas . . .
LONGER LIFE for alloy piping systems
with KEY-KAST alloy steel welding fittings!
AVAILABLE in all
SHAPES . . . SIZES . . .
SCHEDULES . . . IN
LOW AND INTER-
MEDIATE ALLOYS
AND VARIOUS
STAINLESS STEELS.
Check
these PLUS advantages
of KEY-KAST welding fittings against
your alloy fitting needs!
Greater wall thickness throughout—for increased structural strength.
Greater allowance against corrosion and erosion.
Meets A.S.M.E., A.S.T.M. and A.S.A. codes.
Lower unit cost.
Bosses provided on all fittings for tapped openings.
Controlled quality . . . through rigid metallurgical control . . . produced, inspected and tested in one plant.
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Please make request on your letterhead.
key company
Since 1916 . . . manufacturers and developers of products for high temperatures and pressures
DISTRICT OFFICES: NEW YORK • CLEVELAND
CHICAGO • TULSA • HOUSTON • LOS ANGELES

IT'S PACKED
WITH SATISFACTION
WHEN IT'S PACKED
WITH **R/M**

In high-pressure compressors like this, and under all kinds of difficult operating conditions, Raybestos-Manhattan Packings and Gaskets will give long, trouble-free service. R/M Packings are made for high pressures, high temperatures, and extreme low temperatures, as well as for service against caustics, acids, gas, water, steam, petroleum and other commercial fluids. Your R/M distributor can help you select the right packings for your plant. Call him today.

R M

PACKINGS

RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind.; Passaic, N.J.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

HERE'S A FIRE EXTINGUISHER YOU CAN RECHARGE AT ANY AIR PUMP!

1 **CHARGES AT ANY AIR PUMP.** Operates at 150 lbs. pressure.

2 **COVERS GREATER AREA** with Kidde's cloud-like discharge pattern.

3 **POWDER WON'T PACK.** Perfect for trucks, garages, factories, etc.

4 **PRESSURE GAUGE** in pistol-grip handle tells you when air is needed.

5 **TRIGGER ACTION** gives you finger-tip control.

An ordinary air pump will prime this new Kidde dry chemical extinguisher with more fire-killing power than any other unit its size!

See how easy it is to recharge! Just unscrew the head, put in five pounds of dry chemical, screw the head back on and it's ready to take on air pressure from any plant or service station air pump.

And see how easy it is to operate! One hand swings this portable extinguisher into action. One finger squeezes the trigger. Poof! A cloudlike pattern of dry chemical smothers the fire while you remain safely behind a curtain of heat-absorbent powder.

This revolutionary new Kidde extinguisher is so safe, so sure, you'll find it a necessity for trucks, garages, oil storage rooms, bulk plants—wherever there is a danger of small fires.

Write today for full information.

Kidde

Walter Kidde & Company, Inc.
554 Main St., Belleville 9, N. J.
Walter Kidde & Co., of Canada, Ltd., Montreal, P.Q.

1902 • 1952

50 YEARS OF QUALITY LEADERSHIP

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD

You Can Place Full Confidence in the Product of the Manufacturer Who Has Chosen CONTINENTAL RED SEAL as the Heart of His Machine

SEE OUR CATALOG IN COMPOSITE CATALOG

PARTS AND SERVICE EVERYWHERE

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Continental Motors Corporation

MUSKEGON, MICHIGAN

THOUSANDS KNOW IT PAYS TO RELY ON

Toledo

LEADER IN PIPE TOOLS FOR 50 YEARS

Toledo leadership started a revolution in pipe tools 50 years ago...inventing easy-threading tools with receding die segments instead of solid dies.

You've heard it said, "There's no substitute for experience"—and this has a two-way meaning to countless thousands of mechanics who are long-time users of Toledo Pipe Tools.

Experience of the man on the job has shown that Toledos are tools he can trust! Easy handling . . . accurate threading . . . time-saving . . . high production tools that produce *leak-proof joints* and *reduce costs!*

50 years of experience at the Toledo factory keeps the entire line of Toledo Pipe Tools, Power Pipe Machines and Power Drives *steadily improved* . . . always out-front in performance and dependability. May we send you our 50th Anniversary Brochure telling how pipe tools can serve you better? Write . . . The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

TOLEDO

PIPE TOOLS . . . POWER PIPE MACHINES . . . POWER DRIVES

Factory and General Offices at Toledo.

Toledo Simpact, 1" to 2" threader.

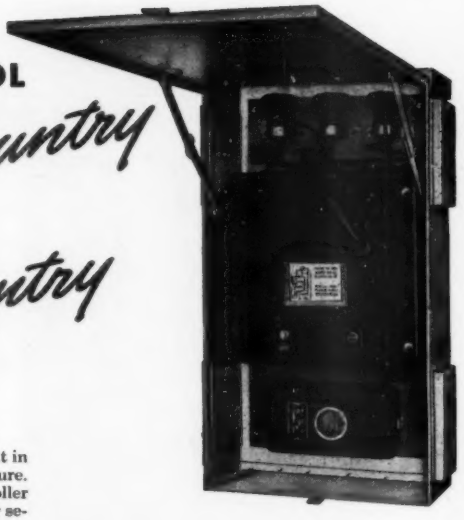
Toledo No. 999 2" Power Pipe Machine.

CUTLER-HAMMER

OIL WELL PUMPING CONTROL

designed in the oil country

built for the oil country



Cutler-Hammer went into the oil country to design its oil well pumping control. The thoroughness of its research is shown by the outstanding performance and preference for this controller.

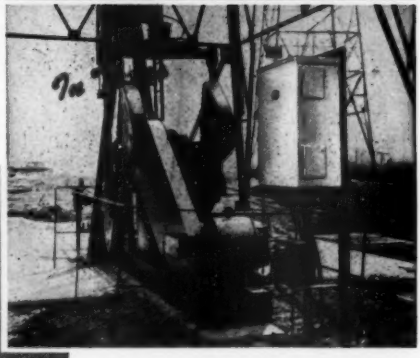
Cool operation. Intelligent ventilation, sound construction, proper design of overload heater coils, aluminum painted enclosures keep this controller *cool*. You never see a C-H Controller with its door propped open to keep it working.

Dependable performance in dust-laden air. Triple protected ventilation openings, Cutler-Hammer's exclusive vertical dustsafe contacts, a neoprene-gasketed dust-proof enclosed timer and a timer clock motor with excess torque keep this controller working

Automatic staggered restarting. Although the Cutler-Hammer Controller is available *without* undervoltage relay, and *with* undervoltage relay, the most popular type has automatic restarting on a staggered schedule. Attendant doesn't have to go out in the storm after a power failure. He knows the C-H Controller will start up motors in proper sequence after such voltage failures.

Other features. Lightning arresters are the unit type. Should one blow, that fact is revealed at a glance. And you don't have to virtually rebuild the starter. Changes in pumping sequence are made in definite 15 minute increments just by pulling small accessible tabs. Resetting of clock after stoppages is made simply by turning a handy palm-size dial forward or backward. Wiring diagram, spare parts list and overload heater coil ratings are printed on a plastic-coated, dirt, grease, heat and moisture repellent sheet enclosed in each starter case.

There's dependability, ruggedness and performance plus in these Cutler-Hammer Oil Well Pump Controls. CUTLER-HAMMER, Inc., 1453 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.



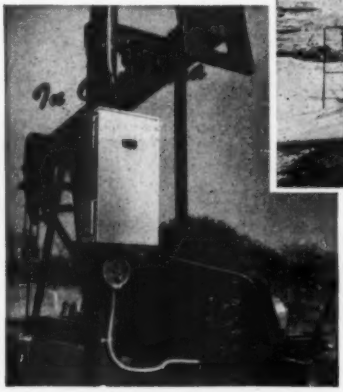
OTHER CUTLER-HAMMER PRODUCTS FOR THE INDUSTRY

Bulletin 9589 Combination Starter

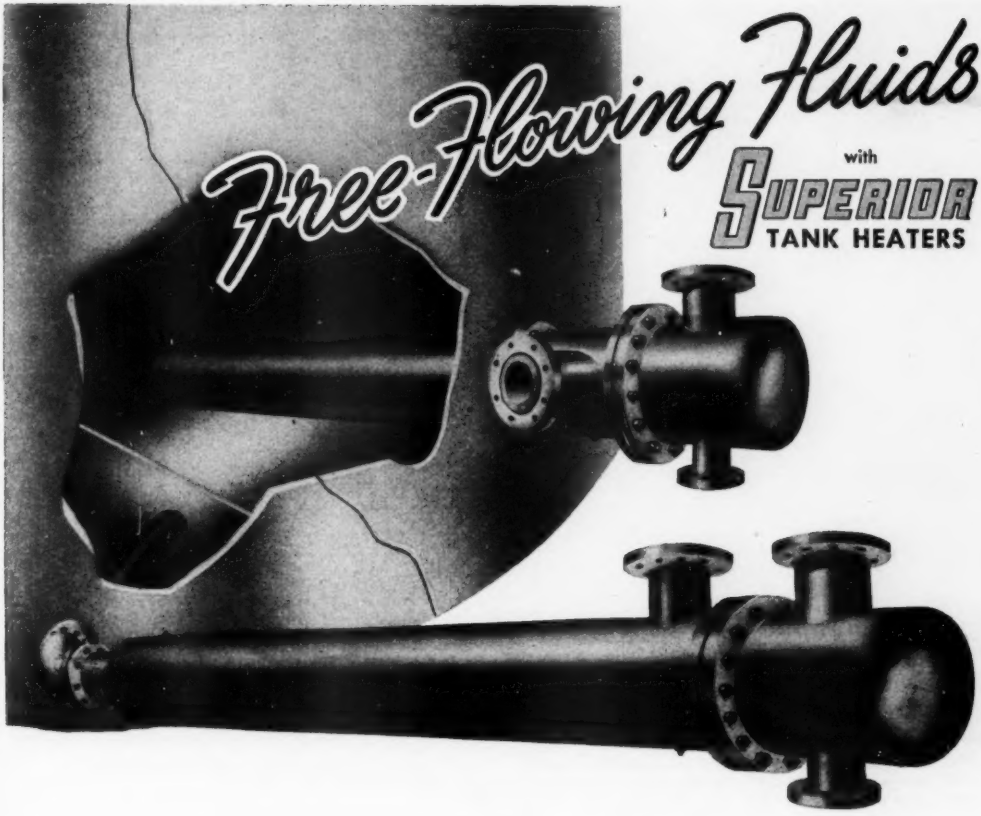
Across the line starter for squirrel cage motors, with side operated knife blade type disconnect switch combined in same special service enclosure. Completely wired. Saves time of installing two separate items.

Bulletin 9739 Across the Line Starter

For use with two speed consequent pole type polyphase squirrel cage motors. Form 1, selective, for pushbutton or automatic pilot device. NEMA 7 enclosure for hazardous locations.



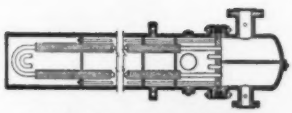
CUTLER-HAMMER
MOTOR CONTROL
C-H



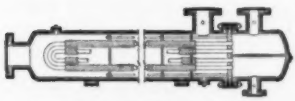
Free-Flowing Fluids

with

SUPERIOR TANK HEATERS



Open-end Type C1U is designed for internal installation . . . applying heat directly at the point of suction.



Type C2U provides for installation exterior to the storage tank. Tubes may be bare, or finned, as required.

SUPERIOR TANK HEATERS are used to heat viscous fluids pumped from storage *without the necessity of heating the entire contents of the storage tank.* With steam, or other heating medium supplied to the "U" tubes, only the liquid withdrawn from storage is heated to the required temperature.

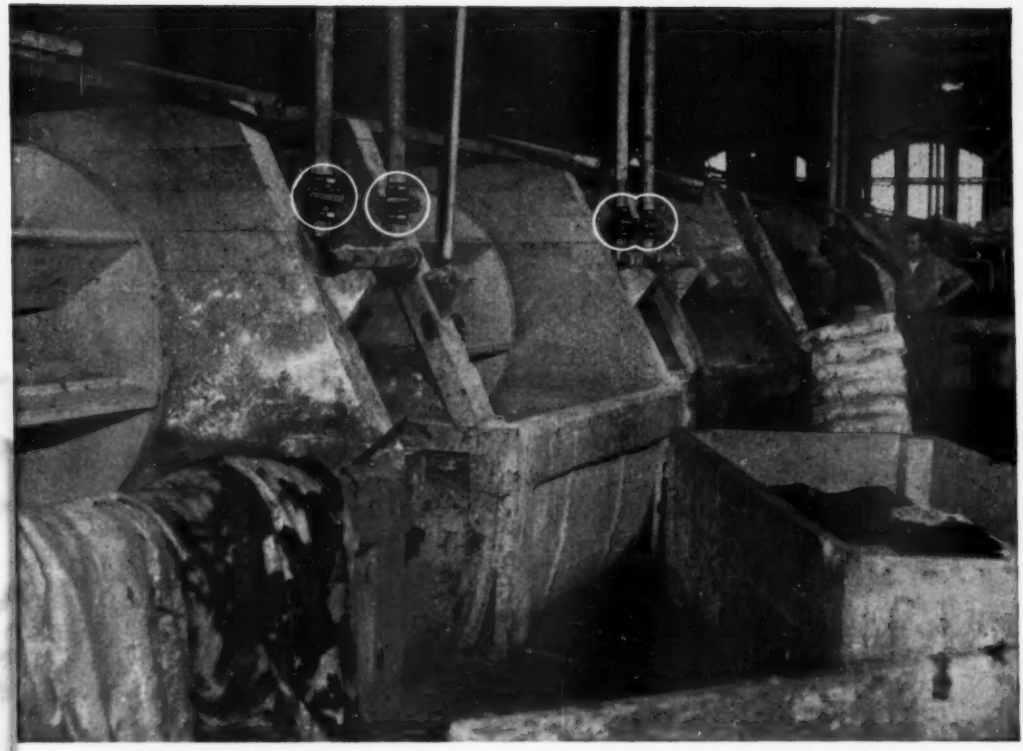
SUPERIOR Heat Exchangers are available in a wide range of sizes and in a variety of shell, tube-bundle, and head designs to meet all conditions of heating, cooling, condensing and evaporating.

Our engineering staff invites your inquiry regarding any proposed installation . . . as a basis for a specific engineering recommendation. For details of construction, write today for fully illustrated Catalog 520.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

SUPERIOR
HEAT EXCHANGERS



IN THE BEAMHOUSE above, Rockwood Ball Valves proved their worth in service. This tannery process removes hair from hides through "liming." Valves must be opened and closed constantly, must resist lime and acid vapors.

"Quickest, easiest valves to open and close,"

REPORTS TANNERY

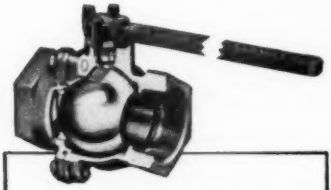
"They're sure built to take it," declares Cornelius Baltas, foreman of the Beamhouse, Creese and Cook Company. "And the Rockwood Ball Valve helped speed production, too. My men found them easy to get at, quick to open, quick to close — a big feature when opening and closing occurs all day long."

In this tannery installation, Rockwood Ball Valves carried water at 200° F to 220° F into lime paddle. Being leakproof, they prevented costly damage to hides from hot water . . . also proved resistant to strong lime and acid vapors that attack metals.

YOU, TOO, CAN BENEFIT

Tough tannery conditions are among many in which the use of Rockwood Ball Valves proves invaluable. Thousands of these valves are providing outstanding service in oil refineries, food, paper, textile, chemical, and rubber plants. Used in lines handling all types of liquids and gases, such as carbon dioxide, nitrogen, paraffin and asphalt base petroleums, alcohol and others. Available in bronze in pipe sizes from ½" to 2" and in cast steel from 3" to 4". Recommended for 300 psi working pressure. Approved by Underwriters' Laboratories, Inc.

If you are not already using Rockwood Valves, plan now to benefit from them. For further details, write for Bulletin V-4 today. Get complete data including prices and applications.



- **LEAKPROOF SERVICE**
- **FULL ROUND FLOW**
- **QUICK OPENING AND CLOSING**
- **NO MAINTENANCE**

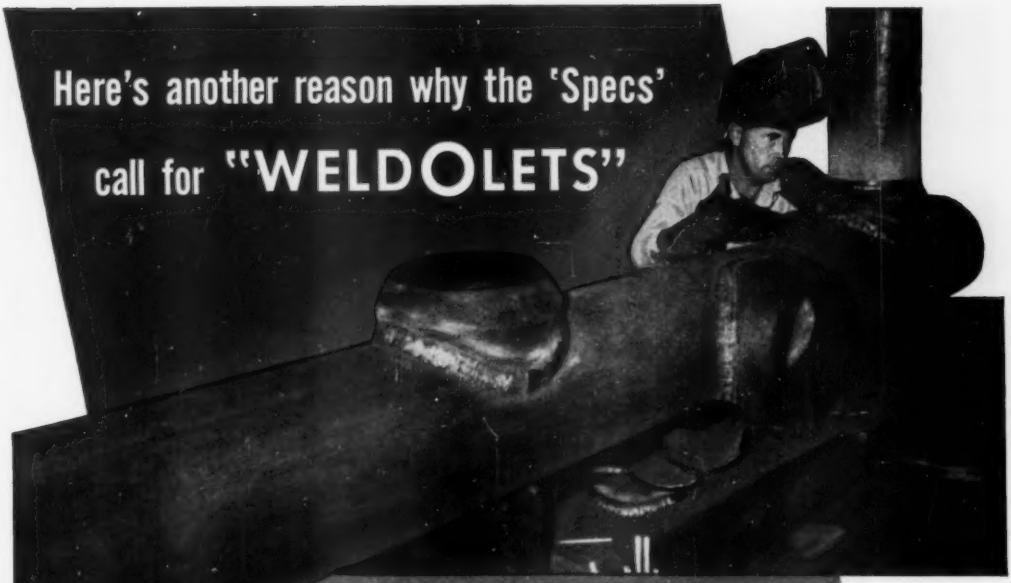
Distributors in all principal cities

ROCKWOOD

ROCKWOOD BALL VALVES

ROCKWOOD SPRINKLER COMPANY, 104 HARLOW STREET, WORCESTER 5, MASS.

Here's another reason why the 'Specs' call for "WELDOLETS"



Extra strong WeldOlets, butt-welding, utilized to make fully reinforced branch connections in Gas Measurement Headers to operate at 1000 psi.

LET'S COMPARE THE PLUS FEATURES OF WELDOLETS AGAINST REINFORCING RINGS OR PADS

1. The WeldOlet is a Welding Fitting rather than a hand-made reinforcement of a hand-made joint. It is both a mechanical and a pressure member.

2. The self-aligning, shaped and beveled WeldOlet is equally adaptable for shop or field fabrication. Its employment eliminates the need for additional reinforcement.
3. Production economy is realized by employment of WeldOlet construction which speeds up installation time in both shop and field fabrication. Only two welds are required to install WeldOlets.
4. The WeldOlet type of construction inherently provides sufficient reinforcement in accordance with Code requirements to meet or surpass the maximum services of whatever weight pipe is used. To facilitate determination of where it is necessary to reinforce or to use a WeldOlet, the new Bonney catalog W-3 features time-saving data on this subject.
5. Dimensional advantages of WeldOlets allow closer manifolding and cross combinations and provide improved flow conditions.

1. Precious pipe is wasted in making reinforcing rings or pads.

2. Reinforcing rings can be cumbersome to handle and clumsy to fit in both shop and field fabrication.
3. Excessive welding is necessary to complete branch reinforcing requirements according to Code provisions when rings or pads are used. Three separate welds are required. This slows down piece production time in both shop and field fabrication.
4. Lengthy calculations are necessary to determine the amount of reinforcing required when designing for ring or pad reinforcement.

The Bonney Catalog No. W-3 will show you why WeldOlet Welding Fittings offer the quickest, safest and most economical method of establishing and maintaining 100% pipe strength at branch connections in accordance with Code provisions. Write for your free copy.

CANADIAN REPRESENTATIVE
Sterling Steel Co., Ltd.
267 Davenport Road
Toronto 1, Canada

EXPORT DISTRIBUTOR
National Supply Co. Export Div.
600 Fifth Ave., New York 20, N.Y.

WELDING FITTINGS DIVISION
BONNEY FORGE & TOOL WORKS
300 FINDLAY STREET, ALLENTOWN, PENNSYLVANIA

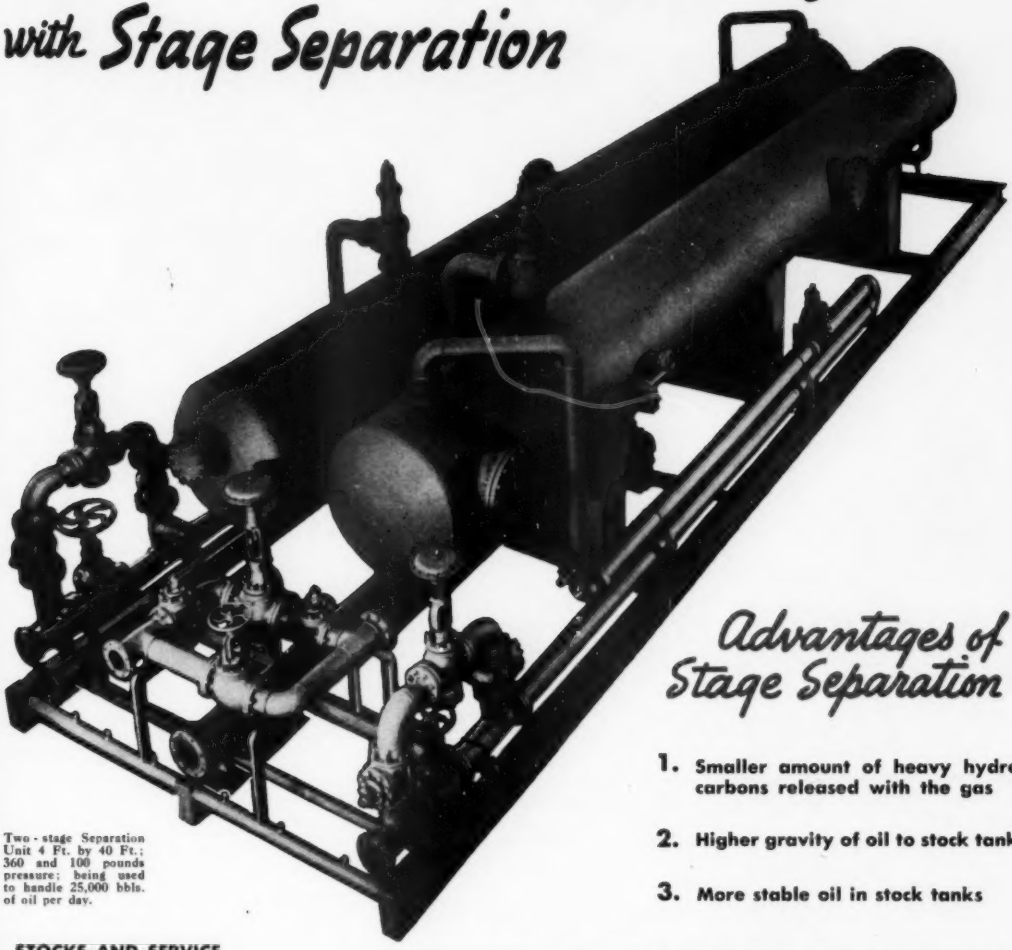
For range of "availability for duty," you can't beat this small gate valve with the forged steel body and yoke. And it handles *every* job with the same Chapman top standard of performance. Here's why:

Any *extra stress* more than meets its match in the *extra strength* of the stem and wedge-gate connection. Added life for seat rings and gate faces is obtained by using super-hardened stainless steel. Seizing or galling of seating surfaces is prevented by gates (with certain types of trim) super-hardened by Chapman's *Malcomizing* process to at least 800 Brinell.

You can get List 960 in sizes from ½" to 2", and equipped with rising stem — either with yoke as shown above, or with inside screw. Bonnet joints are gasketed or metal-to-metal. Pressure range: 2,000 lb. at 100°F.—380 lb. at 1,000°F. For higher pressures, specify List 990. Catalog No. 10 is yours for the asking. Write to The Chapman Valve Manufacturing Company, Indian Orchard, Mass.

The CHAPMAN VALVE
Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

More Efficient Recovery with Stage Separation



Two-stage Separation Unit 4 Ft. by 40 Ft.; 360 and 100 pounds pressure; being used to handle 25,000 bbls. of oil per day.

Advantages of Stage Separation

1. **Smaller amount of heavy hydrocarbons released with the gas**
2. **Higher gravity of oil to stock tanks**
3. **More stable oil in stock tanks**

STOCKS AND SERVICE LOCATIONS

Artesia, N. M.; Corpus Christi, Tex.; Dallas, Tex.; Edmonton, Canada; Farmington, N. M.; Fort Worth, Tex.; Houston, Tex.; Lafayette, La.; Midland, Tex.; New Orleans, La.; Odessa, Tex.; Oklahoma City, Okla.; Pampa, Tex.; San Angelo, Tex.; Snyder, Tex.; Tulsa, Okla.; Wichita Falls, Tex.

Maloney-Crawford packaged, skid-mounted stage separator units offer all the advantages of two stage separation plus the additional benefits of being completely shop assembled and skid mounted. They can be furnished with or without a by-pass arrangement whereby the individual separators may be by-passed, if desired. Tying in with field lines is only connection work required. Completely portable they may be used either for permanent or test installations. Variety of combinations in working pressures available.

MALONEY CRAWFORD

MALONEY-CRAWFORD TANK & MFG. CO

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION MEMBER

FACTORY AND GENERAL OFFICE: 38 NORTH PEORIA—BOX 659—TULSA, OKLAHOMA
EXPORT REPRESENTATIVE: Baird Lines, 420 Lexington Avenue, New York, N. Y.
CANADIAN REPRESENTATIVE: Maloney-Crawford of Canada, Ltd., Edmonton, Canada
TEXAS PANHANDLE REPRESENTATIVE: H. W. Waddell, Pampa, Texas.

AHEAD OF THE SLUSH PIT

First there's financing by the FIRST in Dallas

the Southwest's Pioneer Oil Bank

GIVE US AN OPPORTUNITY TO SAY · YES ·

FIRST NATIONAL BANK *in* DALLAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

ADDING NEW STRENGTH TO INDUSTRY!

Third blast furnace to increase Kaiser Steel's production of new metal 50%

THE urgent need of more steel is as clear as the front page of your newspaper. And the production of steel *must* start at the heart of a steel mill—its blast furnaces, which make pig iron for conversion into steel.

To help meet this need, Kaiser Steel—now operating the only two blast furnaces on the Pacific Coast—has started construction of a third. Scheduled for completion in the spring of 1953, this blast furnace will increase Kaiser Steel's pig iron output by 50 per cent—438,000 additional tons a year.

Kaiser Steel's expansion program, entirely privately financed, also includes:

. . . a ninth open hearth furnace to increase production of steel ingots

. . . ninety new by-product coke ovens to supply coke to the blast furnaces

. . . two new roll stands in the present hot strip mill, to enable it to roll sheet of lighter gauges and greater widths.

This new expansion, providing an increased supply of iron and steel, will add more strength to the many industries served by Kaiser Steel. Another reason why—

It's good business to do business with

Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅛" to 12¾" O.D.	Up to 55'	.188" to .400"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Houston, Tulsa, New York

The finest welding fittings available are made from seamless steel tubes forged in Globe's Foren Mill . . . the only one of its kind in the entire Steel Tube Industry.

GLOBE WELDING FITTINGS ARE BORN HERE

Only Globe seamless welding fittings are precision processed from *billet* . . . to *tube* . . . to *fitting*

Globe precision-process manufacture begins with the billet — continues through the making of the seamless steel tube — and extends through to the production of the finished fittings.

The exacting controls in Globe's precision process — plus specialized research, testing and engineering insure uniform high-quality and close tolerances. Be sure of dependable fittings . . . always specify Globe.

For complete information on the finest welding fittings available anywhere, send for the Globe Welding Fittings Catalog.

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Chicago • Cleveland • Detroit • Philadelphia • St. Louis
Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.

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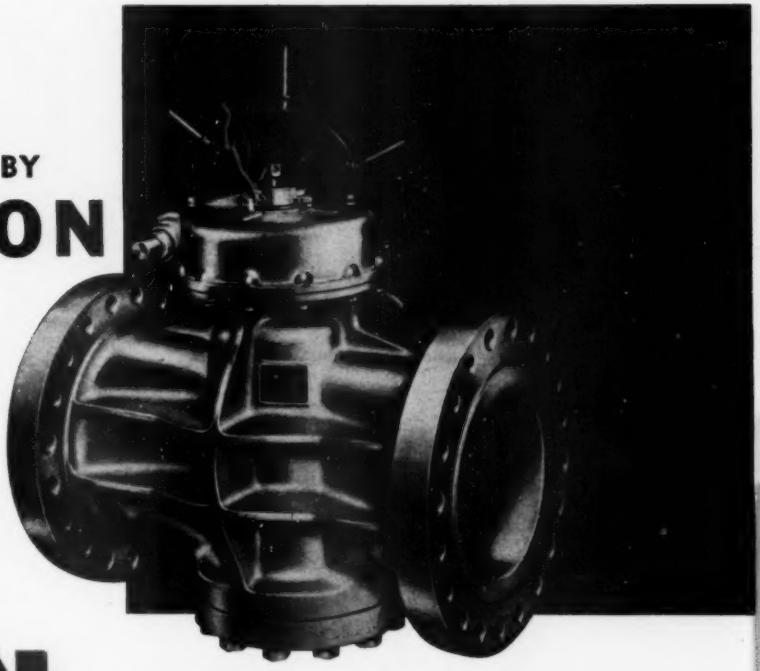
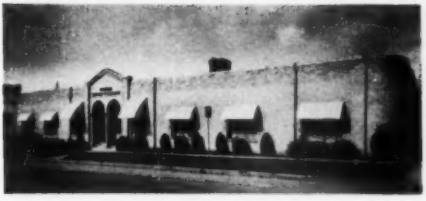


NORDSTROM

LUBRICATED PLUG VALVES

VINSON • TULSA



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Nordstrom, pioneer manufacturer of lubricated plug valves, is recognized throughout the oil industry as the leader in its field. Contributing to this position of leadership is Nordstrom's continuing research program . . . making technical advances in keeping with the demand for valves of extreme stamina.

Stocked in both iron and steel, and in all pressure ratings, Nordstrom valves are carried in all popular sizes in the four Vinson warehouses. Special emphasis is placed on valve types used by the oil industry and other industries in the southwest. Write for our bi-monthly stock list.

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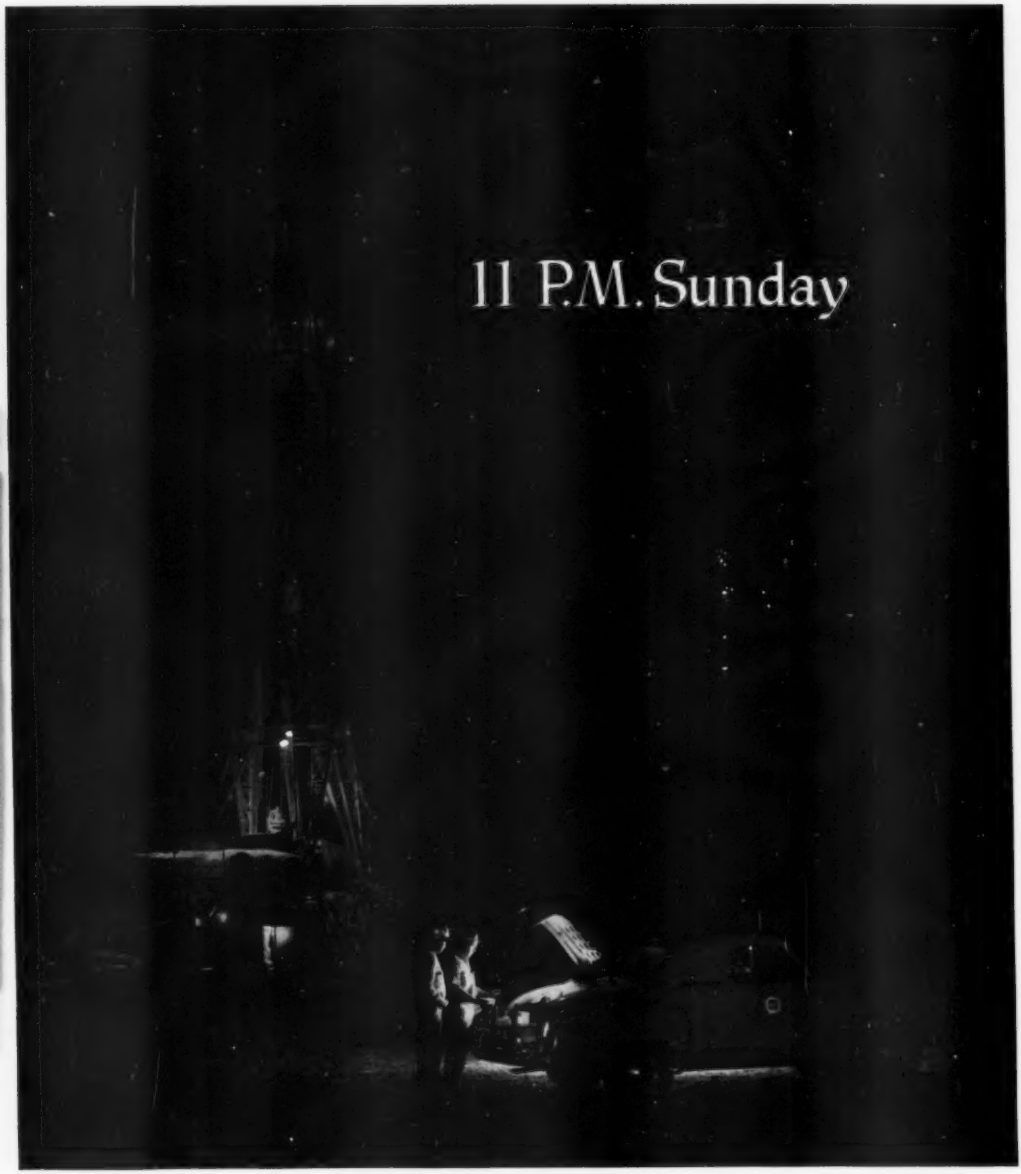
DALLAS – Dixon 3983
ODESSA – 6-4351
SNYDER – 1148



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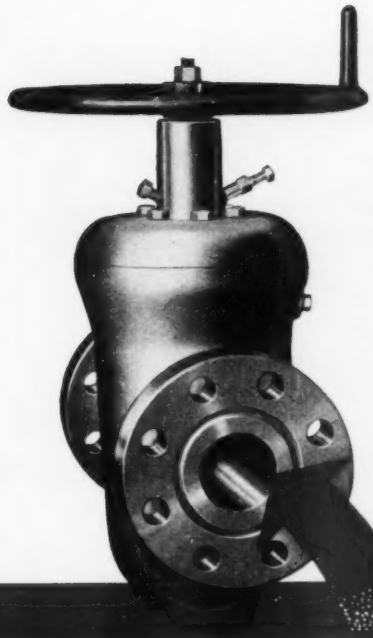
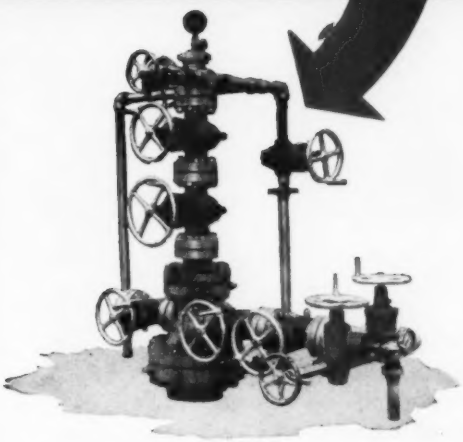


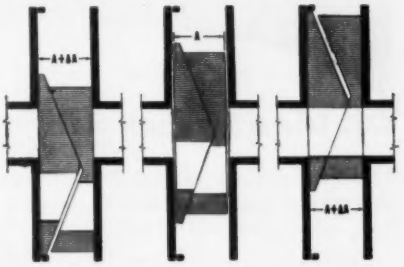
NO TURBULENCE HERE

means long valve life...

low maintenance here



W-K-M Valves have a perfectly smooth bore which has about the same resistance to fluid flow as an equivalent section of smooth wall pipe. There are no cavities or projections to cause destructive turbulence or to collect sediment. The gate and the seats are fully protected against cutting or damage of any kind. These operating advantages are a result of the W-K-M Expanding Gate development which is illustrated below.



In closed position, the gate (left) and segment (right) seal tightly against both seats.

When opening or closing, the gate and segment are in neutral position, permitting free upward or downward movement of the gate assembly.

When open, the gate and segment again seal tightly against both seats and the bore of each lines up perfectly to provide a smooth, turbulence-free passage.

The W-K-M Expanding Gate design also provides free-running opening and closing under full rated pressure and gives extremely high seating pressures. For easy operation, W-K-M valves also have superfinished stems, double thrust bearings and precision ground stem threads.

These engineering and operational features are among the reasons why 80% of the world's high-pressure wells are controlled by W-K-M valves. Specify W-K-M when you want sure, positive control all over your Christmas Tree.

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W-K-M Valves

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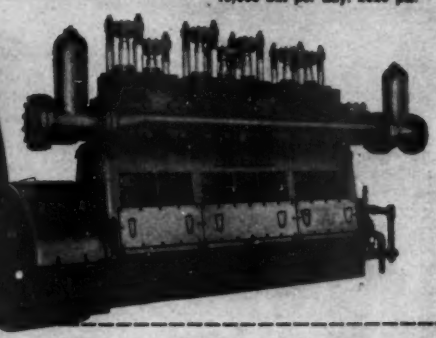
Oversize Replaceable Seats • Pressure Seal Bonnet • Double Row Thrust Bearings on Stem • Internal Lubrication

FOR THESE SERVICES:

water flooding, salt water disposal, lean oil service, crude and gathering lines, bottom hole pump service, product lines, pumping liquids such as butane, propane, ethylene, diethylene glycol, etc.



3½" x 6" Septuplex. 250 rpm. 15,000 bbl per day. 2020 psi.

Oil Men Select Aldrich Direct Flow Pumps because

. . . operating speeds are high. You get whatever volume and pressure you need from a smaller, lighter, more compact pump.

. . . fluid-ends are sectionalized. Parts can be replaced at low cost and can be made of stainless steel, bronze, Monel or other special materials necessary for corrosive fluid service.

. . . maintenance is simplified. No more tapered bores in the working barrel to make valve removal difficult. Now, manifolds slide out on studs and you can lift out valves as complete units. Packing is very easy to renew due to the accessibility of the stuffing boxes.

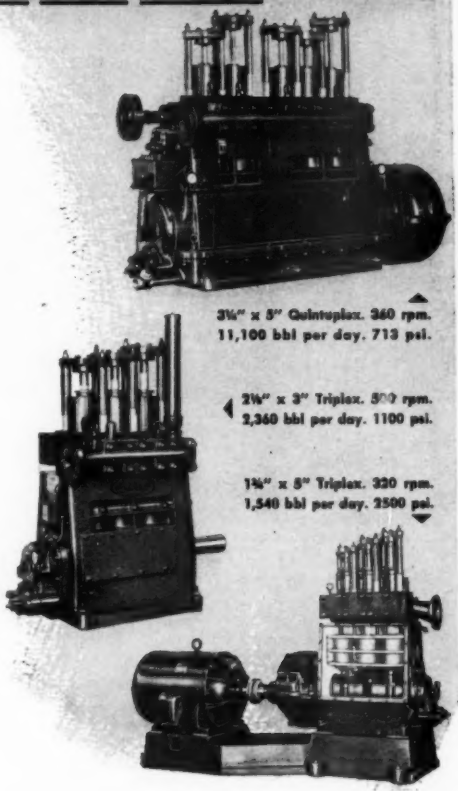
. . . plunger sizes are changeable. In many cases it is only necessary to add—besides plungers—new glands, throat bushings and packing to the same fluid-end. "Kosmos" Porcelain Plungers are standard for salt water service.

. . . wearing parts are interchangeable among 3, 5, 7 and 9 plunger pumps of the same stroke sizes. This minimizes spare parts costs and inventories.

. . . ample stocks of spare parts are maintained at Mid-Continent and California locations.

For information or catalogs, contact your nearest Aldrich representative . . . or write us direct.

Statistics shown here are for pumps operating on actual projects. Other size pumps, other volumes and pressures are available.



3½" x 5" Quintuplex. 360 rpm. 11,100 bbl per day. 713 psi.

2½" x 3" Triplex. 500 rpm. 2,360 bbl per day. 1100 psi.

1¾" x 5" Triplex. 320 rpm. 1,540 bbl per day. 2500 psi.

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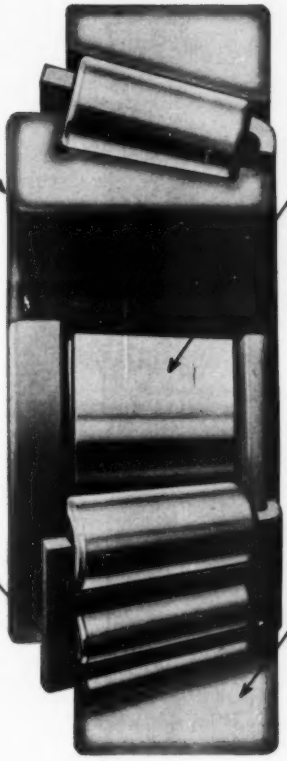

1 GENEROUS RADIUS — for greater shaft strength.

2 CHOICE OF 26 DIFFERENT TYPES.

3 SOFT STEEL CAGE — to keep rollers separate and prevent scuffing.

4 PRECISION MANUFACTURE — which makes possible bearings with a maximum runout tolerance of less than 75 millionths of an inch.

5 CASE-HARDENED BEARING SURFACES — to resist wear.

6 MICRO-INCH SURFACE FINISH — to minimize friction.

7 CHOICE OF 5850 SIZES.

8 TIMKEN FINE ALLOY STEEL — specially developed to give long bearing life.

9 TOUGH CORE — to resist shock.

10 POSITIVE ROLLER ALIGNMENT — to prevent skewing and give maximum capacity.

. . . the tapered roller bearing you want is TIMKEN®

TIMKEN® tapered roller bearings give you more advantages than any other make. Ten of these advantages are listed above. They result from the fact that the Timken Company is the foremost producer of tapered roller bearings and leads in 1) advanced design, 2) precision manufacture, 3) rigid quality control, and 4) special analysis steels.

Be sure every tapered roller bearing you use carries the name "Timken", the trade-mark of The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

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Axelson "TLE" (Tubing Liner) Pump shown. There is an Axelson Deep Well Plunger Pump for every specific well condition.

Axelson *makes sure you get what you order!*

Knowing what to order is one thing, being sure you get what you order is quite another. The Axelson policy of rigid control and inspection at every stage of manufacture is centered in the laboratory. Here, deep well pump raw materials are subjected to exhaustive chemical and physical analysis including tests for tensile strength, hardness, impact, hot acid etch and fatigue. And when all these tests are concluded, tabulated and checked against each other, there can be no question about quality. Axelson leaves nothing to chance. This is why Axelson deep well pumps are giving maximum, trouble-free service in wells all over the world—and have been for many, many years. This is why it is—*AXELSON Chosen first...to last!*

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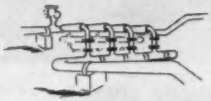
at the wells . . .

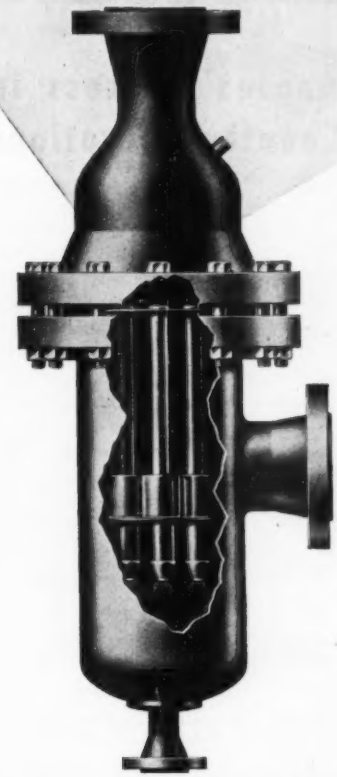


in the pipelines . . .

DRY GAS SCRUBBERS

assure you efficient natural gas cleaning

without liquid filters



Aerotec Dry Gas Scrubbers offer you a highly efficient means of removing dusts and distillates from gas. In the "Big Inch" and many other installations at wells and in pipelines, these units are daily proving the advantages of *dry* scrubbing.

The Aerotec Gas Scrubber uses no oil or other liquid as a filtering medium. This eliminates carryover and other normal disadvantages of conventional type scrubbers. By keeping the gas clean and dry, Aerotec units help prolong the life of compressors and reduce pipeline maintenance.

Aerotec precipitating tubes are the heart of this dry scrubber. Gas passes through these multiple, small-diameter tubes, and the foreign matter is separated from the gas by centrifugal force. Discharge is continuous.

Space-saving compactness, light weight, and piping simplicity of the Aerotec Dry Gas Scrubber permit easy installation. The standard units are available in practically any size up to 100,000,000 SCFD. Manifolding meets needs for larger capacities. Our representative will gladly recommend the Aerotec Scrubbers your specific gas-cleaning problem requires. Call or write today.

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Manufacturers

THE AEROTEC CORPORATION

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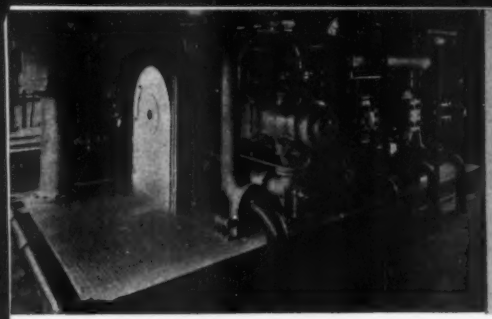


Two Clark Midget Angles furnishing gas for gas lift service and to recycling plant at Cranfield, Miss.

Battery Two, Lake St. John Field, La.: Clark Midget Angle supplying gas to the Lake St. John gasoline and recycling plant.

Perfect Balance and

. . . explain Clark Midget Angles' success in The California Co.'s Bayou Country operations

Bayou country, rich in oil and gas but difficult for men and machines to work. That is the story of producing operations in the southern part of Louisiana and Mississippi. The California Company, however, has found the practical answer to the flare gas and gas lift problem in these rich producing fields.

Seventeen Clark 300 bhp Midget Angle "skid-mounted" compressor stations are now operating under extremely rugged conditions. Because of perfect balance, only a slab of concrete is needed for a foundation. Several of these skid-mounted units are even operating on small 18-foot x 36-foot, floating steel barges. Most of these field compressor stations are operated in isolated locations, with only a minimum of service and attention. It is readily apparent why a compressor selected for this toughest kind of service must be inherently rugged and durable. Only the Clark Midget Angle matches these service requirements perfectly. An on-stream average of 97 per cent of the time is proof of dependable performance.

If you have a problem involving 80 to 330 bhp gas-engine-driven compressors, for hard field service, investigate the Clark HMA for the most practical answer.

CLARK BROS. CO., INC. • OLEAN, N. Y.

One of the Dresser Industries

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Barataria, La.: Clark Midget Angle pumping flare gas into a natural gas pipeline.

Brookhaven, Miss.: Clark Midget Angle discharging at 2500 psi into injection wells shown in background.

Battery Four in Lake St. John Field, La.: Two Clark Midget Angles furnishing gas for gas lift services and for gasoline plant at nearby Lake St. John.

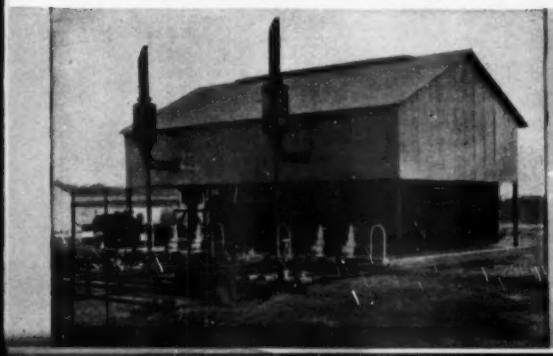
Clark Midget Angle handling 2-pressure services of field gas for Cranfield, Miss. recycling plant.

Stamina

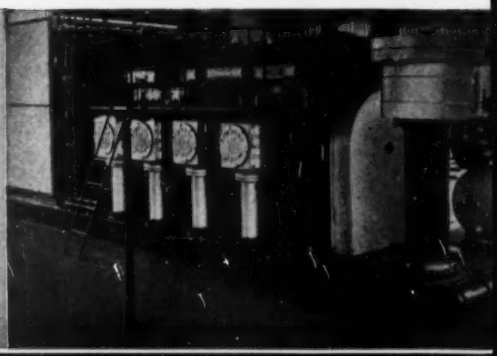
Delta Farms, in Bayous of Louisiana: Two Clark Midget Angles operating on individual floating barges. Perfect balance makes this possible.

CLARK® compressors

Two Clark Midget Angles supplying gas through 2-pressure services to nearby Lake St. John recycling plant.



Hico Knowles, La.: Clark Midget Angle supplying gas through 2-pressure service for nearby recycling plant.



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choose GARDNER-DENVER booster compressors

Sizes from 5 to 275 h.p.

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single stage or two-stage units

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electric motor or gas engine drive

You'll hit a high score in efficiency and dependability when you install Gardner-Denver Compressors for booster service, re-pressuring or air-gas lift. Tailored to your field conditions, they're available in a wide range of capacities and pressure ratings. They're complete, compact units—easily trucked in—ready to hook up and start up.

Call your nearest Gardner-Denver field engineer for complete details, or write us.

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GARDNER-DENVER

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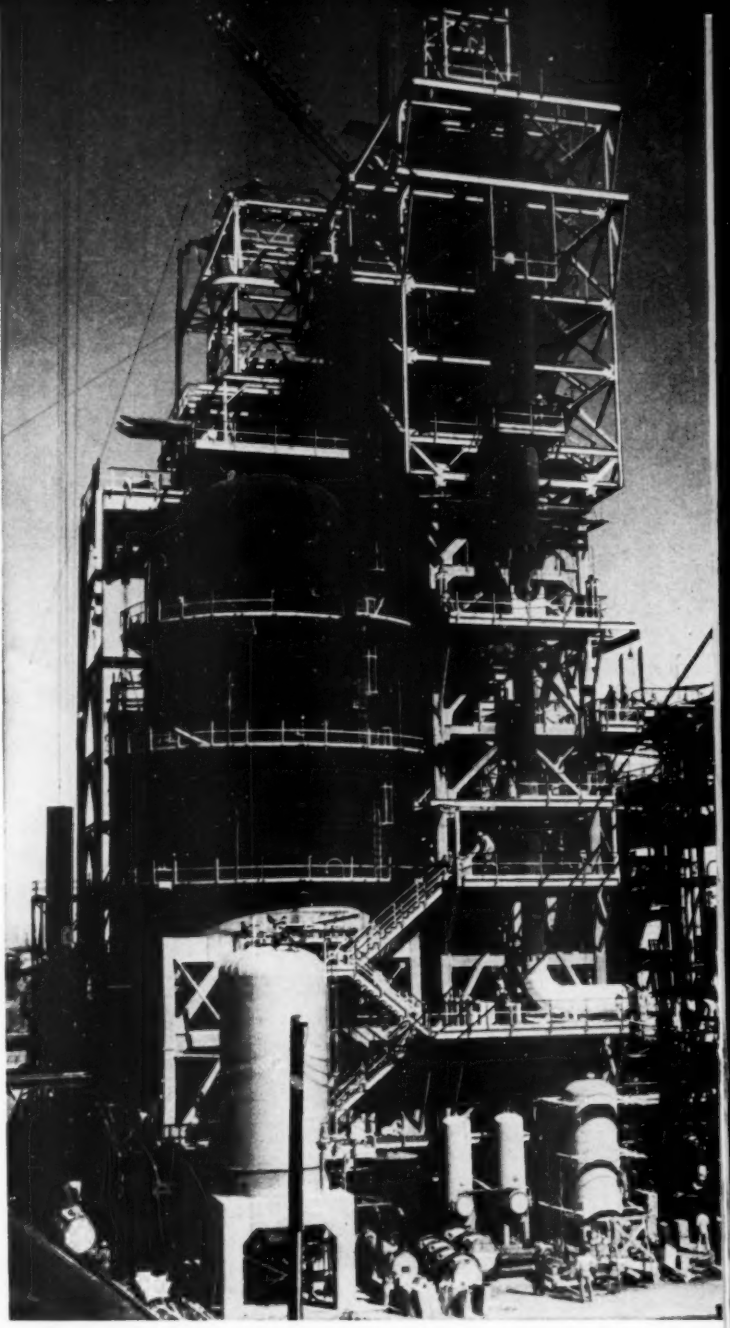
THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

NEW PACIFIC COAST FLUID CAT ★ CRACKER



THIS new 28,500 B/D Fluid Catalytic Cracking Unit nearing completion at Wilmington, California, is being built by Arthur G. McKee & Company for the Union Oil Company of California.

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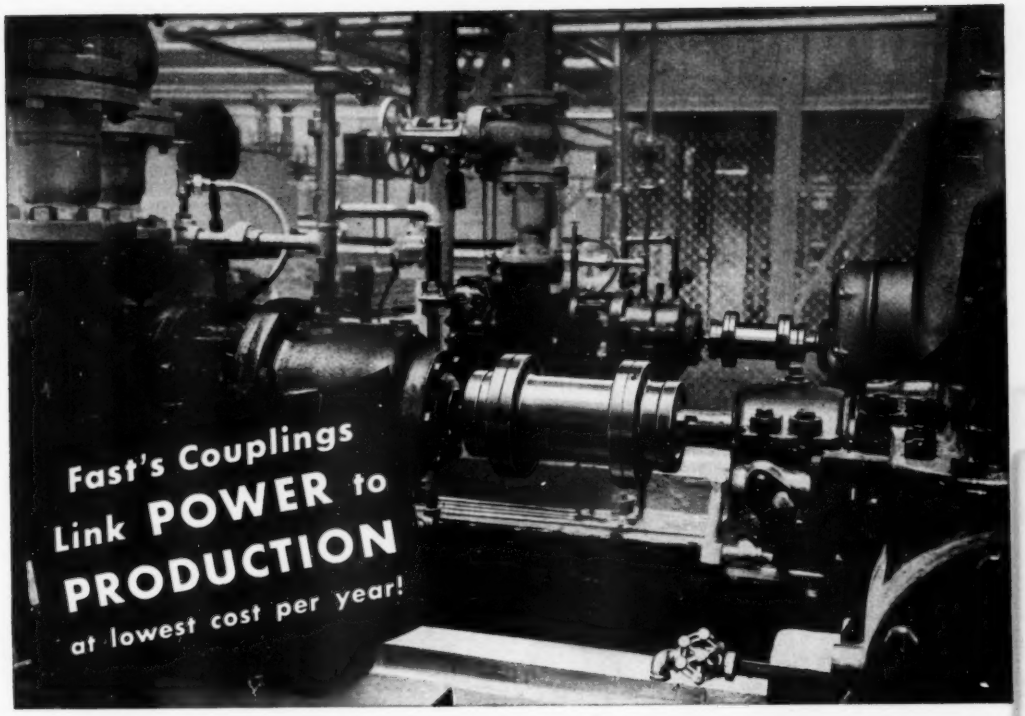

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HIGH-SPEED equipment demands components with superior strength, accurate manufacture, long-lasting dependability. That's why it's important to *you* that Fast's Couplings are selected by every major high-speed equipment producer!

Fast's usually outlast the equipment they connect. Many have been in continuous operation for over 30 years, without trouble of any kind. And Fast's longer life saves you coupling dollars, too, because you amortize their cost over many years of trouble-free operation.

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The **First Barrel** is Service in the Field . . .
the free service which provides engineered answers to practically every major packer problem. Whether you're concerned with setting a packer or pulling a packer, or with packer maintenance and repair, or how best to employ packers on your completions, your Lane-Wells man is trained to give you solid, down-to-earth aid and information.

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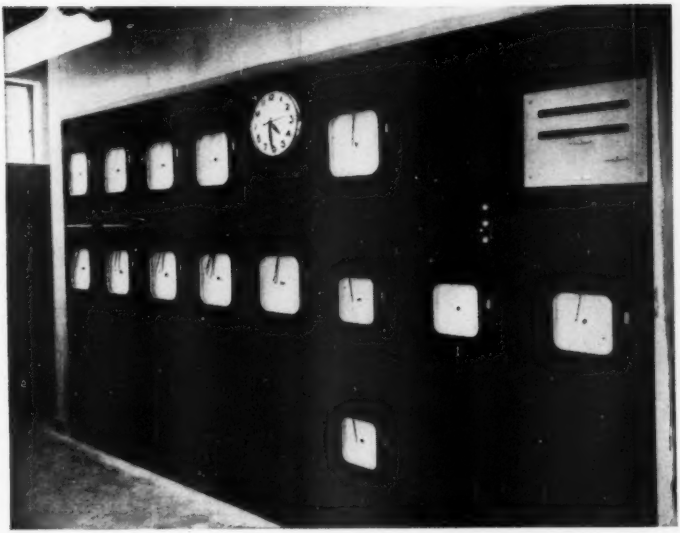


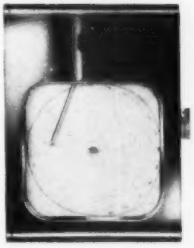
The picture to the left shows the control panel at the new Point Richmond Holder Station of the Pacific Gas and Electric Co. The Metameter Receivers on this panel record readings of flow and pressure at focal points of load in the distribution and transmission systems for the San Francisco Bay section. This installation is part of an elaborate system of Metameter telemetering and remote control, involving distances up to 50 miles, used on this company's far-flung network of pipe lines throughout northern and central California. This company is using Metameters that have been in operation since 1935.

METAMETER* TELEMETERS AT WORK IN SAN FRANCISCO

Remote Control and Telemetering Have Been Important Factors for Many Years in the Efficient Operation of Pacific Gas and Electric Company's Distribution Systems

BRISTOL METAMETER TRANSMITTER makes measurements and transmits information any distance over any two-wire circuit or its equivalent telephone circuits, private wires, radio (including microwave) and carrier channels.

BRISTOL METAMETER RECEIVER is available with round, narrow or wide-strip chart or as indicating receivers.



The value of remote control and telemetering in the efficient operation of a gas distribution system has been thoroughly demonstrated over the past 16 years by the Pacific Gas and Electric Company. Here, over 100 Bristol Metameter telemeters are used to record, at central control stations, the pressure and flow in gas lines at key points throughout its transmission and distribution systems. Continuous records of pressure and flow made immediately available to the dispatchers enable them to operate systems by remote control at peak efficiency. Write for Bulletin M-1700. The Bristol Co., 120 Bristol Rd., Waterbury 20, Conn.

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PERFECT TEAM ★

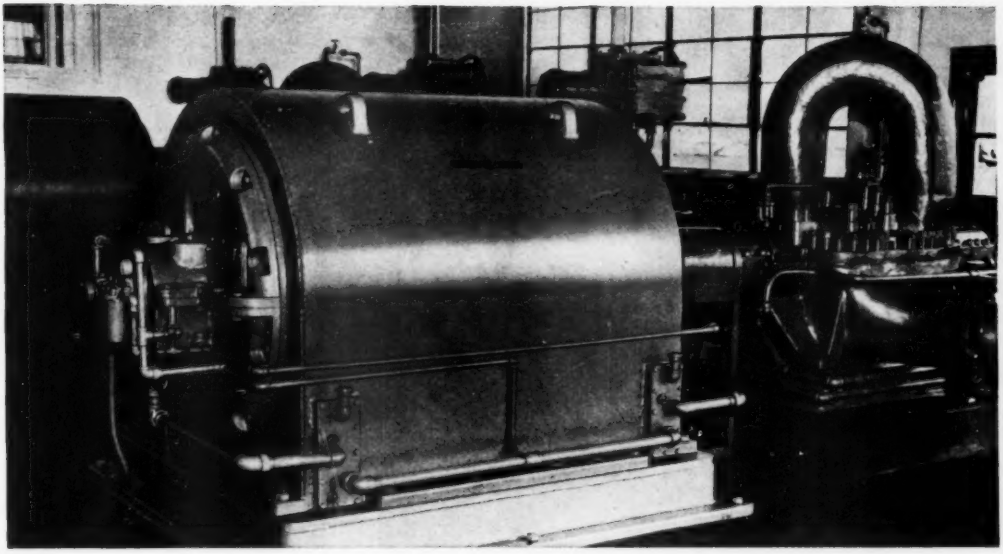
TULSA ★ WINCHES *for* Trucks and Crawler Tractors

And another rig moves on to location quickly, easily and safely with TULSA WINCH-mounted truck and tractors. In capacities ranging from 6000 to 80,000 pounds, Tulsa Winch offers 28 winch models for all makes and models of trucks and crawler tractors. For detailed information and specifications on Tulsa Winches, contact your nearest distributor or write direct to

Tulsa ★ Winch
DIVISION OF VICKERS Inc.
TULSA, OKLAHOMA
815-22 E. First Street

Reg. U. S. Pat. Off.

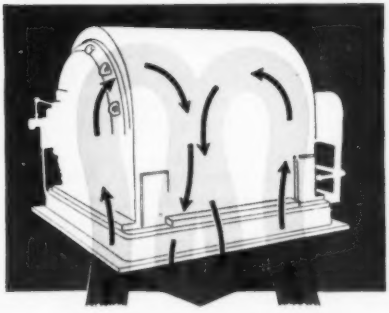
THE WORLD'S LARGEST MANUFACTURER OF TRUCK POWER WINCHES



These two G-E forced base-ventilated motors—each rated 1500 hp, 2300 volts, 3600 rpm—drive centrifugal pumps in the Mayersville, Miss. station of the Mid-Valley Pipeline Company's 22-inch crude oil line. Two other stations in this 1000-mile line are similarly equipped.

All-enclosed cooling... all-around protection!

In new oil pipeline station, G-E motors require no extra equipment; separate motor-driven blowers remove motor heat, keep out hazardous gases



Simplified sketch shows how air inlet and outlet passages in motor's base all open directly down through the foundation to the source of ventilating air. By first starting a separate motor-driven blower, any hazardous gases are cleared from the main motor before latter is started.

Driving pipeline pumps that deliver 157,000 barrels per day, these two General Electric 1500-hp forced base-ventilated motors with separate motor-driven blowers combine both protective and low-cost advantages:

(1) Separate motor-driven blower—started up in advance—purges the main pump motor and duct system of any gases that may have accumulated during a shutdown period. It also removes heat quickly and effectively from the main motor during operation.

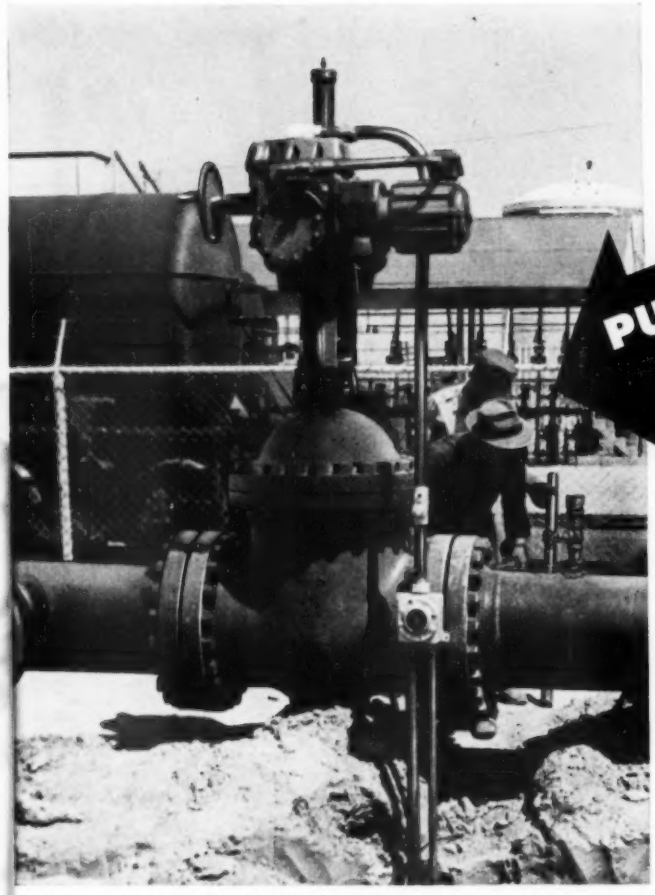
(2) Base ventilation—with both intake and discharge ducts located below floor level—does away with unsightly piping and the possibility of hazardous leaks through exposed pipe joints. In addition, a firewall between motor and pump is generally not needed, further reducing station construction costs.

These motors are part of a broad G-E line for every electrified pipeline need. Let a G-E pipeline specialist help you select the right motors for *your* pipeline, and write for bulletin GEA-5423 on electrification of oil pipelines. *General Electric Co., Schenectady, N. Y.*

661-32

Everything you need to cut oil pipeline costs —ELECTRICALLY!

GENERAL ELECTRIC



PUT IT IN... FORGET IT!

it's a Darling pipe line gate valve

Typically, this motor-operated, 18" Darling cast steel gate valve of the fully revolving, double disc parallel seat type, is now cutting costs and maintenance on a major cross-country products line.

WHEN it's a Darling pipe line gate valve you *can* forget it—for longer than you ever thought possible! Despite extreme temperature changes, despite severe line stresses, this valve closes tight every time. It requires less maintenance. You get *surer* valve performance, year in, year out.

It's all a matter of principle—a unique but simple one—*Darling's fully revolving, double disc, parallel seat* principle! It automatically compensates for valve body distortion, equalizes disc and seat wear, cuts down-time and maintenance to the bone!

Get *all* the facts—money-saving, time-saving facts that make these Darling gate valves preferred equipment today in all kinds of oil and gas line service everywhere. Simply outline your particular service needs or ask for a complete descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

Since 1929, A. O. Smith has been helping the petroleum, Petro-chemical, chemical and paper industries solve many of their difficult corrosion problems.

The Ultimate JUDGE is TIME

Smithlined vessels have been in continuous corrosive service for over 20 years without failure of the lining attachment or the vessel itself.

This history of service is significant. It confirms the findings of our own research laboratories and supports the designs of our engineers, that closely controlled resistance-welding of stainless or other corrosion resistant liners to carbon steel vessel walls is the best means of providing long-term service and satisfactory performance under specific corrosion, pressure and temperature conditions.

If you have a corrosion problem, let A. O. Smith work with you in solving it. Our engineers and laboratories have an unequalled background of experience and data gained from hundreds of successful applications of Smithlining. Contact our nearest district office.

78th

A.O.Smith

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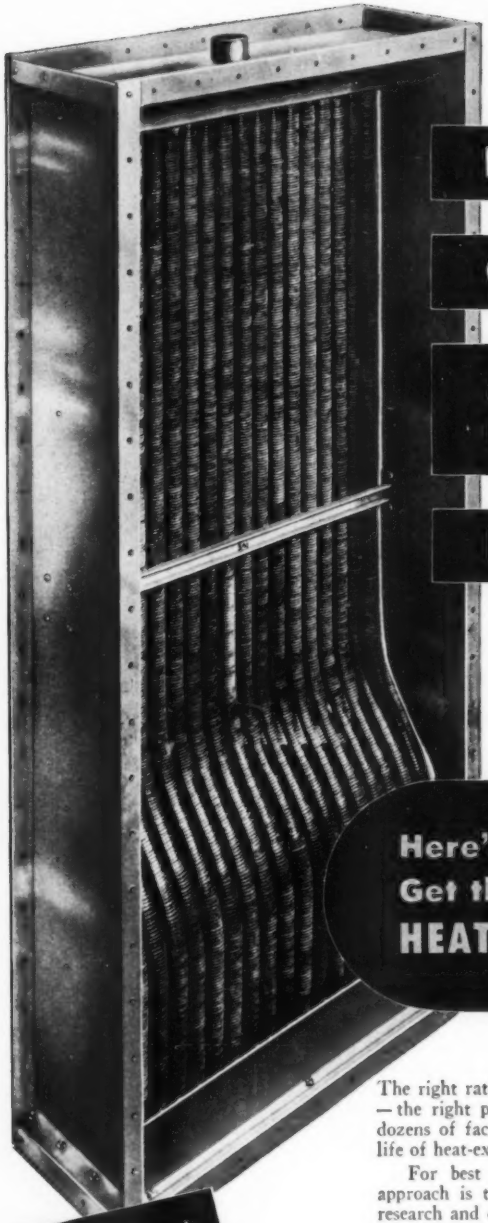


Heating?

Cooling?

Air Conditioning?

Process?

Here's How to Get the RIGHT Answer to your HEAT-EXCHANGE PROBLEMS

The right ratio of surfaces – the right materials – the right velocities – the right proportion between coil area and depth . . . there are dozens of factors that affect the efficiency, maintenance and service life of heat-exchange coils.

For best performance in your own application, the practical approach is to take full advantage of the unequalled engineering, research and design skill – the unequalled manufacturing and testing facilities – which Aerofin offers you.

To get the *right* answer – ask the Aerofin man.

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

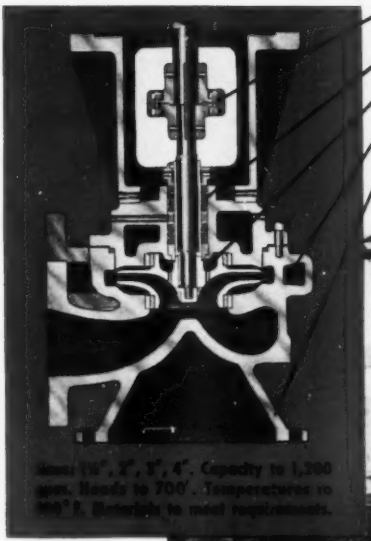
AEROFIN CORPORATION

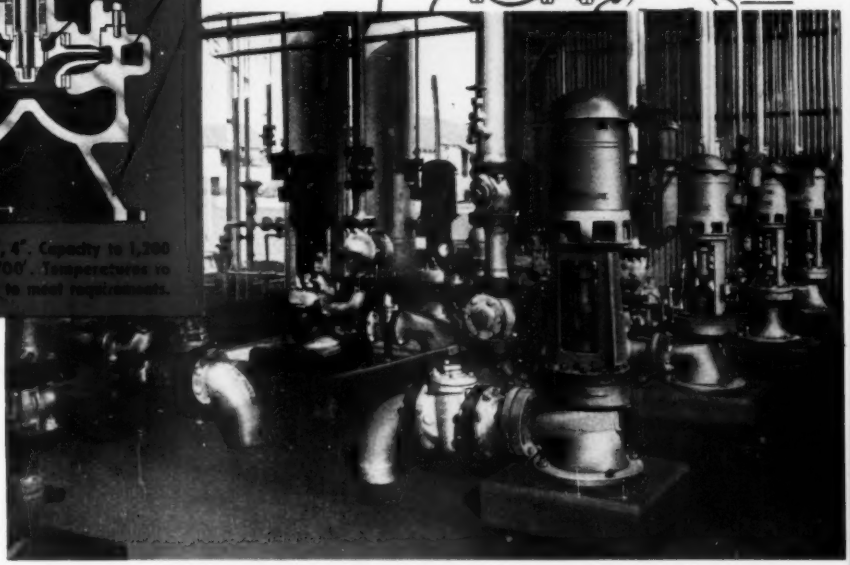
410 South Geddes St. SYRACUSE 1, N. Y.

Gasoline Plant gets

More Capacity in half the Space

with UNITED VERTICAL PROCESS PUMPS


Rigid type coupling. Spacer type furnished with mechanical seals.
Stuffing box normally under suction pressure.
Hydraulic balance virtually eliminates thrust, permits use of normal thrust motor.
Double volute insures radial balance over entire operating range, minimizes wear.
Vertical mount saves space, eliminates need for base plate.



Typical of the many installations now in service coast to coast, Warren Petroleum Corporation operates these eight United Series VTC vertical process pumps at their Holliday, Texas natural gasoline plant. Note economy of space with ample access area.

Combining vertical compactness with exacting processing requirements, United Series VTC pumps save valuable floor space, simplify piping and eliminate need for special bases. Along with these installation economies, United vertical process pumps offer the basic operating advantages found in United's horizontal TC Series—modern double volute design on all above 1½" sizes assures radial balance to minimize deflection and wear—axial balance allowing use of normal thrust motors—plus many other United features. As with all United Pumps, each unit is tailored to the specific job it is to do, assuring maximum performance and life. If you have process pumping problems, request Bulletin 5-220, or contact your United Representative today.

UNITED CENTRIFUGAL PUMPS

Division of United Iron Works

Main Offices and Plants: Oakland 7, California

Sales Offices: LOS ANGELES · HOUSTON · TULSA · ST. LOUIS · CHICAGO · CLEVELAND · MONTREAL · NEW YORK

Here's proper distribution of weight and power!

That's one BIG reason why a four-wheel-drive is so superior. But that advantage is COMPLETE only in a *true* 4x4 such as this light-duty LD.

SAFE TRANSPORT is furnished by the LD for geophysical equipment and supplies.

A DRILL RIG is carried by this LD for use wherever dynamite is to be planted.

THE LD USED AS A SHOOTING TRUCK, moves across rough terrain to exploration holes faster.

Exploration crews say, "Now we reach more locations under our own power — without winching." With power *factory engineered* into all four wheels, the light-duty Model LD pulls through deep mud and sand, climbs steep trails, pushes through underbrush . . . *gets over terrain on schedule.* FWD's proper distribution of weight and power is responsible for this superior performance over *conversions* and *conventional* trucks. For facts, ask an FWD distributor. The FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis., Canadian factory: Kitchener, Ontario.

Built by the makers of America's Foremost Heavy-Duty Trucks

You buy more than a truck when you buy an FWD

Extra traction and proper distribution of weight and power help you:

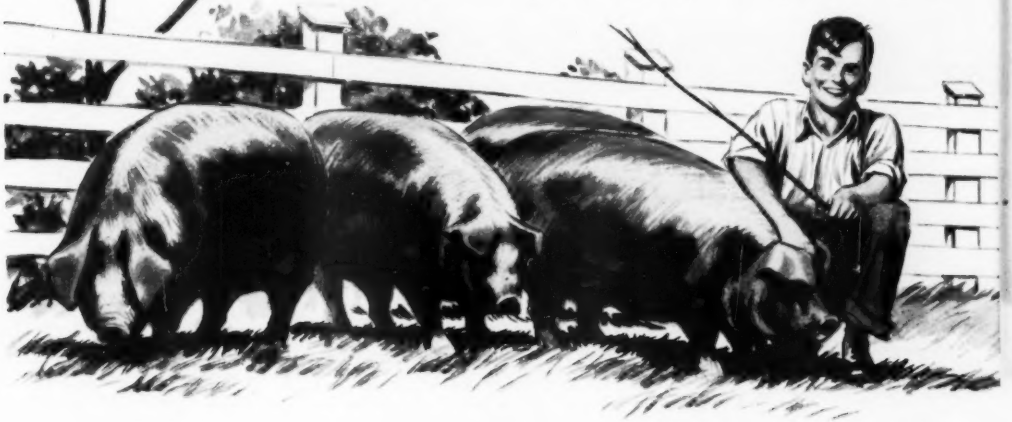
- Travel where other trucks can't go
- Drill more holes per day—every day
- Keep contract schedules
- Avoid field breakdowns and down-time
- Get greater safety — on or off the road

World-Wide Sales and Service

PIPE'S IN THE PICTURE TOO—

Farm goals today are greater than ever before—and pipe's doing a tremendous job in upping crop and livestock production. Whether you look at corn in Iowa, sugar beets in Colorado, cattle in Texas or poultry or hogs in almost any state of the Union, you'll find steel pipe insuring a dependable water supply, releasing farmers from the age-old rule of the weather.

Whatever you do, wherever you are, pipe's in *your* picture too, serving you safely, silently, dependably, economically day in and day out, 24 hours a day—365 days a year.

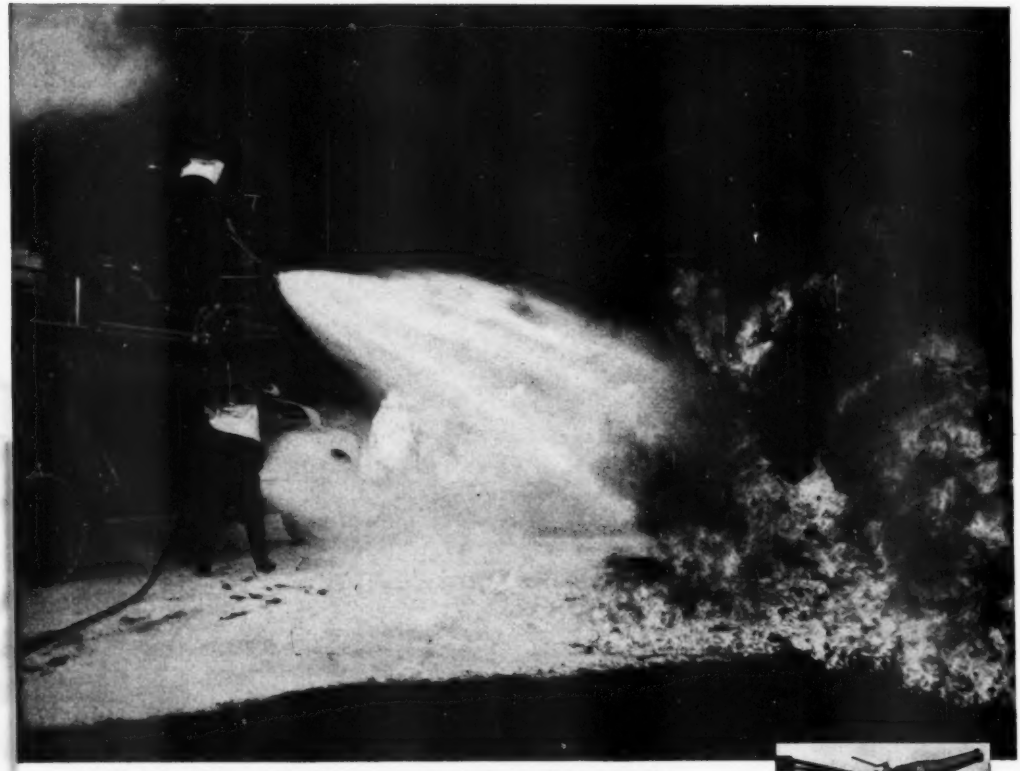


WHEATLAND TUBE COMPANY

BANKERS SECURITIES BLDG., PHILADELPHIA 7, PA.

Get in the scrap for defense. Spot-check your plant today!

-pipe with the yessssh!



FogFOAM is discharged directly into flames, smothering fire in seconds.

Plane Crash Fire Controlled in Seconds

. . . *with Rockwood-equipped fire truck*

When Pratt & Whitney Aircraft division of United Aircraft Corporation decided to design a really outstanding fire truck, they turned to Rockwood for the special fire-fighting equipment needed. The result? A mobile unit that controls aircraft crash fires in seconds.

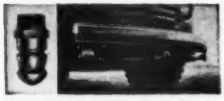
Two Rockwood FogFOAM Turret Nozzles mounted over the driver's cab are unique features of the unit. They discharge huge quantities of FOAM or FogFOAM into the fire, smothering flaming gasoline and blanketing wreckage. The Rockwood FOAM flows freely at sub-zero temperatures, clings to metal surfaces as an insulator, can be easily washed away after fire is put out.

If crash fires occur, the truck can speed directly to the scene . . . reaching any corner of a 650-acre flying field in one minute. Test fires have been controlled in less than 30 seconds!

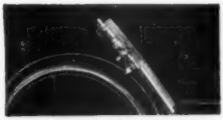
Similar equipment is used for fighting gasoline spill fires on city streets, refineries, industrial plants, etc.

Get the Complete Facts! Rockwood's contribution to the Pratt & Whitney Aircraft truck is but one of many successful applications of Rockwood fire-fighting equipment. All types of equipment to combat all types of fires are available at Rockwood—or made to individual requirements. For complete details, send for your copy of our new illustrated catalog.

ROCKWOOD Type FFF FogFOAM Turret Nozzle can be manually operated from roof of cab. Other types of Rockwood Turrets can be hydraulically operated from within cab. Provides 4 different types of discharge: FogFOAM, solid FOAM stream, WaterFOG, and solid water stream.



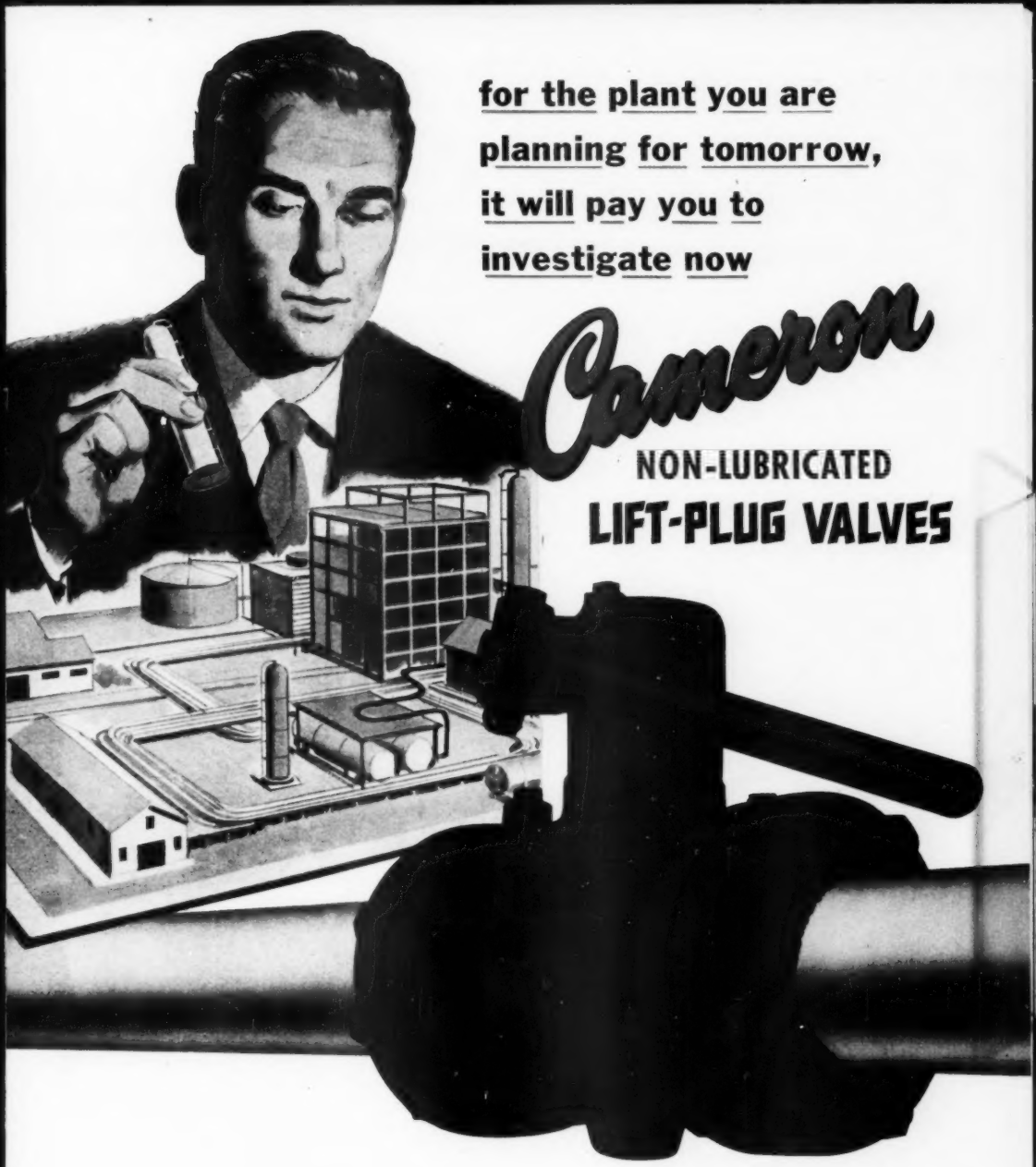
ROCKWOOD Under Truck Nozzles and Ground Sweep Nozzles protect front and under parts of fire trucks. Also puts out fires in path of truck. Discharges FogFOAM or WaterFOG.



ROCKWOOD Hand Lines utilize Rockwood SG Type Nozzles. They discharge High Velocity WaterFOG, FogFOAM, Solid FOAM Stream and Straight Water Stream and are available in 1" sizes only.

ROCKWOOD SPRINKLER CO.

104 HARLOW ST., WORCESTER 5, MASS.



for the plant you are planning for tomorrow, it will pay you to investigate now

Cameron

NON-LUBRICATED LIFT-PLUG VALVES

No matter what the service may be, here is a plug valve that fits. Featuring a removable seat and plug, it can be easily and economically trimmed in any desired corrosion-resistant alloy.

The Cameron Lift-Plug Valve requires no lubrication, either for easy operation, or obtaining a tight seal. Think of the man hours and grease it will save you. This feature also prevents contamination of line products by valve lubricants. There is nothing to clog meter equipment either.

Let us send you a booklet that tells you the complete story of this remarkable valve. Like other plant operators who use these valves in particularly difficult services, you may find them to be the answer to all of your problems too.

Cameron **IRON WORKS, INC.**

P. O. BOX 1212, HOUSTON, TEXAS

Export: 74 Trinity Place, New York, N. Y. Represented in the sterling area by: British Oilfield Equipment Co., Ltd., Duke's Court, St. James's, London S.W.1, Eng.

built to GET MORE DONE

THE NEWEST, FINEST LINE ON EARTH!

HD-5
40 drawbar hp.
11,250 lb.

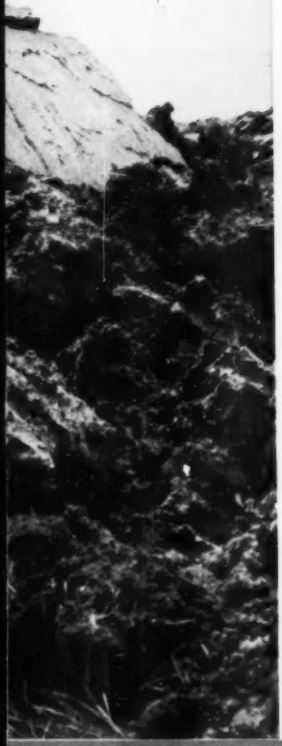
HD-9
72 drawbar hp.
18,800 lb.

HD-15
109 drawbar hp.
27,850 lb.

HD-20
Hydraulic Torque
Converter Drive
175 net engine hp.
41,000 lb.

built to TAKE IT LONGER

Built for the Oil Fields– ALLIS-CHALMERS HD-9, HD-15



Unequalled Lugability

The HD-9 and HD-15 build up greater drawbar pull faster . . . hold it longer than ever thought possible in gear transmission tractors.

For example, when tough going has pulled travel speed down 40 percent, these tractors will have increased their drawbar pull almost 20 percent over rated pull. They will lug down almost 45 percent from rated travel speed before drawbar pull even starts to fall off.

To take full advantage of this important GM 2-cycle diesel engine characteristic, the HD-9 and HD-15 have longer truck frames, lower idlers and sprockets. That means more track on the ground . . . better stability . . . sure-footed traction . . . unequalled *lugability*.

Extra Long Life

Here are a few of the many reasons why these newest, finest tractors are *built to take it*.

- All-Steel Welded Construction
- More Power with Bigger Engines — Longer Engine Life
- More Weight, Greater Strength
- Extra Heavy Main Frames — No Extra Reinforcement Needed for Front-Mounted Equipment
- Long-Lasting, Large Diameter Clutches
- Double Reduction, Straddle-Mounted Final Drive Gears with Live Sprocket Shafts and Caged Bearings
- Positive Operating Track Release — Works in Oil
- All New, Specially Designed Track Assembly
- Positive-Seal Truck Wheels, Support Rollers and Idlers — Mounted on Tapered Roller Bearings, 1,000-Hour Lubrication!

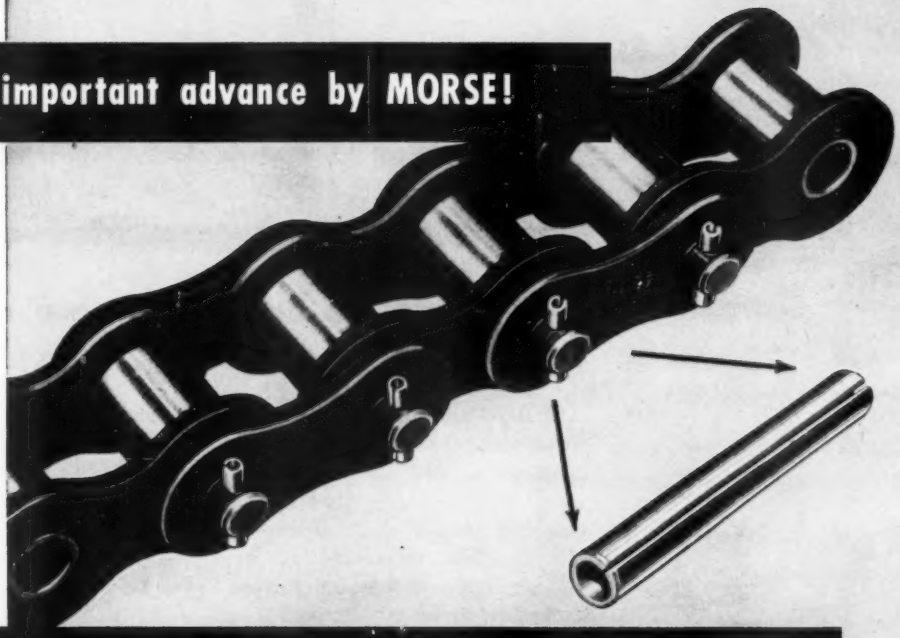
Your Allis-Chalmers dealer will be glad to explain all of these advantages. See him or phone him now.

DESIGNED FOR YOUR JOB • BUILT TO "TAKE IT" • EASY TO OPERATE • EASY TO SERVICE

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Another important advance by MORSE!



Rollpin fasteners now available on five sizes of MORSE Roller Chains

Now, Morse gives you this tested, proved answer to cotter-pin failure in roller chains. It's the Rollpin, most reliable, longest-lived fastener ever incorporated into a power transmission chain.

The Rollpin is a chamfered-end, heat-treated, slotted steel cylinder that is compressed into a pin hole smaller than the Rollpin's own diameter. The Rollpin expands and locks into place until deliberately removed by hammer and punch. It can't fatigue out even under the most severe working conditions.

The Rollpin is another outstanding example of Morse Roller Chain leadership that has already given you the benefits of shot peening and many other advanced metallurgical refinements.

At no increase in price, Rollpin fasteners are currently available in most of the larger pitches of both standard and heavy-series Morse Roller Chains. If you have been experiencing cotter-pin failure, specify Morse Roller Chain *with Rollpins*. Standard cotter-pin chains are available and will be furnished unless otherwise specified.

M = PT Morse *means* Power Transmission

Rollpins outlast standard cotter pins more than ten to one!

Standard heat-treated cotter pin after only 3 hours on fatigue tester.

Rollpin after 50 hours on fatigue tester. It will outlast any other fastener on the market.

MORSE
MECHANICAL
POWER TRANSMISSION
PRODUCTS

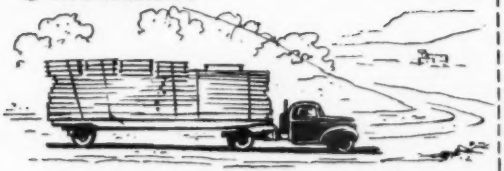
PRODUCTS OF B-W BORG-WARNER

MORSE CHAIN COMPANY

Dept. 328, 7601 Central Ave. • Detroit 10, Michigan

WHY STURDYBILT *Prefabricated* HOUSES ARE *BEST* FOR OIL FIELD HOUSING . . .

● MOVABILITY



Houses, in complete packages, are moved from factory to site, or from one site to another with a minimum of delay, and practically no loss of material.

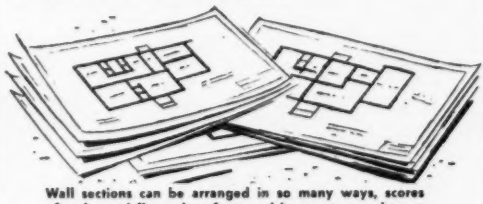
● NO WASTE

Material cost is cut to the minimum because YOU PAY ONLY FOR THE MATERIAL USED. Sections are Prefabricated, and material is cut to fit at the factory.

● SPEED OF ERECTION

Houses delivered in sections are erected in days instead of weeks. Thus you save much costly time of on-the-job labor.

● VARIETY OF DESIGNS

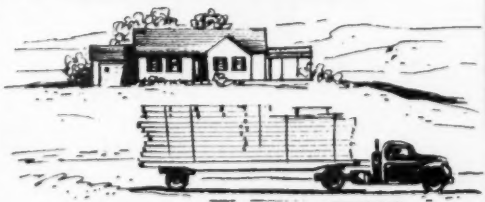


Wall sections can be arranged in so many ways, scores of styles and floor plans from tool houses to warehouses are available.

● WEATHER TIGHT

STURDYBILT sections are precision-built on jigs to assure fitting accuracy. They are tongue and grooved to assure weather-tight construction.

● PERMANENT or TEMPORARY



STURDYBILT Houses over 30 years old are still in use. This record of durability proves that STURDYBILT Houses, although movable, fill the bill for permanent housing.

MANUFACTURERS OF SPECIAL MILLWORK • DISTRIBUTORS OF
JOHNS-MANVILLE BUILDING MATERIALS • CURTIS WOODWORK

STURDYBILT

PREFABRICATED,
DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125
OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

MIDWEST
PREFABRICATED PIPING

SAVES LABOR

SAVES TIME

SAVES MONEY

SAVES TROUBLE

From A Simple Bend

Or Welded Assembly

To Complete Piping Systems For Power Plant

Or Process *Call On MIDWEST*

Midwest Shop-Fabricated Piping saves labor, time, money and trouble in erection. Subassemblies are always practical, with the difficult operations performed in the fabricating plant. Field welding is simplified as much as possible. All pieces are accurate in alignment and dimension . . . they are thoroughly cleaned to remove all scale and dirt . . . carefully inspected and tested . . . stress relieved when necessary . . . ready to erect quickly, easily at lowest cost. It is to your advantage to use Piping Prefabricated by Midwest.

MIDWEST PIPING SERVICE IS NATION-WIDE

4 Plants Are Better Than 1

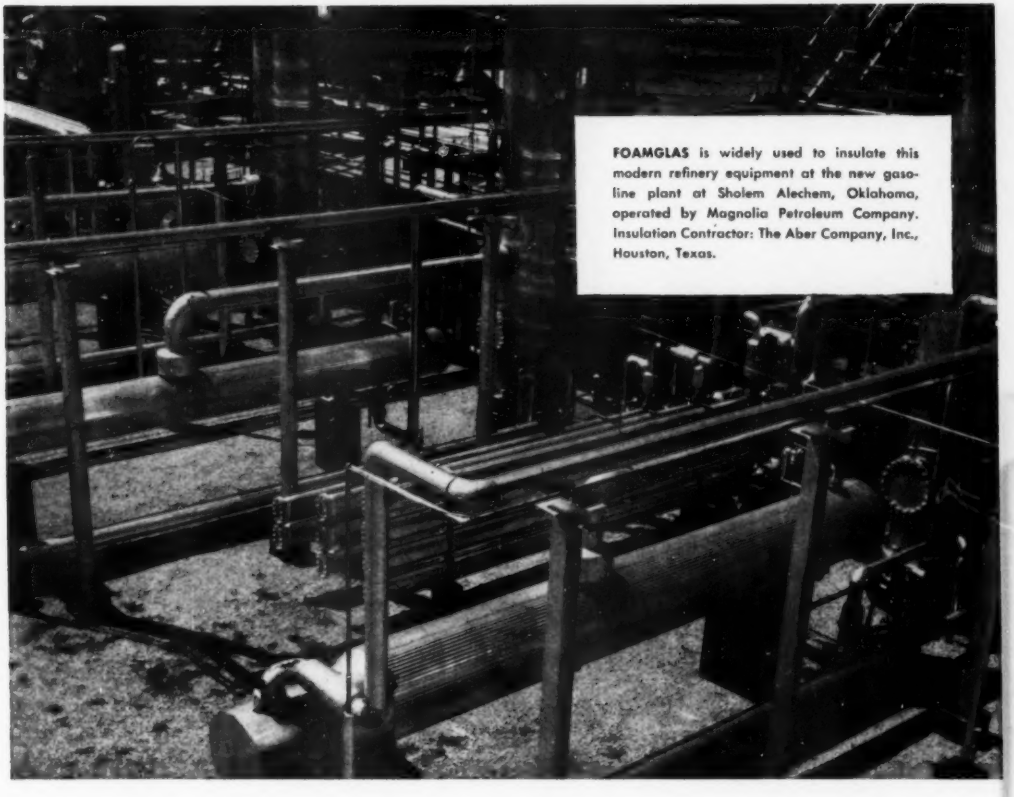
PIPING FABRICATORS AND CONTRACTORS

MIDWEST PIPING & SUPPLY CO., INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices: New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 1—1213 Capitol Ave.
Tulsa 3—224 Wright Bldg. • Boston 27—426 First St.



FOAMGLAS is widely used to insulate this modern refinery equipment at the new gasoline plant at Sholem Alechem, Oklahoma, operated by Magnolia Petroleum Company. Insulation Contractor: The Aber Company, Inc., Houston, Texas.

Out of sight...but hard at work

Under the aluminum finish, FOAMGLAS is doing six important insulating jobs at the Magnolia Petroleum Company's new gasoline plant at Sholem Alechem, Oklahoma. It is helping to maintain exact temperatures on piping, valves, fittings, heat exchangers, towers and tanks.

Its cellular glass construction gives FOAMGLAS exceptional insulating ability, which it *retains* throughout long, trouble-free service. Used successfully on hot and cold work, indoors and outdoors, FOAMGLAS needs no special weatherproofing protection.

Long lasting insulating efficiency and complete adaptability have won FOAMGLAS wide preference in the refinery field. It comes in all wanted sizes for use on pipe lines—plain and factory-wrapped—factory fabricated for use on valves and fittings, and in beveled and curved special shapes for tanks, towers and other process equipment having insulation requirements.

When you need insulation, get the latest information on FOAMGLAS. Send the coupon for a sample of the material and a copy of our current booklet.

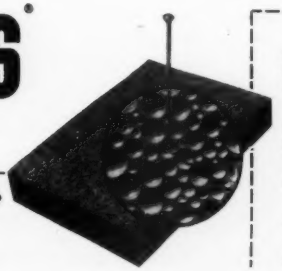
PITTSBURGH CORNING CORPORATION · PITTSBURGH 22, PENNSYLVANIA

PITTSBURGH PC CORNING

FOAMGLAS®

the cellular glass insulation

The *best* glass insulation is cellular glass. The *only* cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, verminproof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.



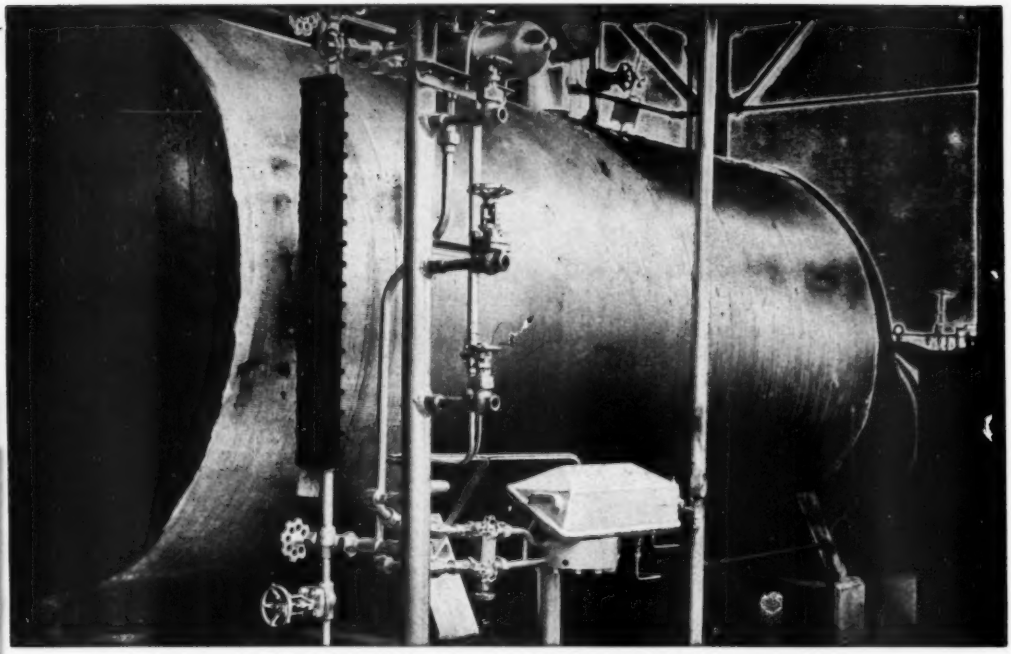
Pittsburgh Corning Corporation
Dept. DD-52, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me, without obligation, a sample of FOAMGLAS and your FREE booklet on the use of FOAMGLAS for Piping and Process Equipment.

Name.....

Address.....

City.....State.....



Republic Transmitter measuring level in reboiler

DIFFERENT . . . in design and performance

The Republic Pneumatic Transmitter is a device for converting process variables, such as flow, level, pressure or liquid density, into air pressures. These air pressures are a direct measure of the process variables or can be used as the measuring impulse for the actuation of an automatic controller.

The force-balance method of measurement, as employed by the Republic Pneumatic Transmitter, offers many inherent advantages such as:

AMBIENT TEMPERATURE — The effect of ambient temperature variations on the accuracy of a Republic Transmitter is negligible. Since all parts are equally affected by temperature changes, force and leverage relationships are not disturbed and accuracy is unimpaired.

AIR SUPPLY PRESSURE—The effects of changes in air supply pressure is so small that it is guaranteed negligible.

LINE PRESSURE — The effect of variations in line pressure has been completely eliminated.

SENSITIVITY—Due to the negligible motions required for complete operation of all parts for full scale changes, no appreciable hysteresis results from reversal of direction of measurement change. The hysteresis loop is so small that it is undetectable by ordinary means, being less than 1/20 of 1%.

ACCURACY — The accuracy of the Republic force-balance method of measurement is higher than can be consistently secured and maintained with any other method. Transmitting pressure vs. measured force is guaranteed within ½ of 1% of meter range.

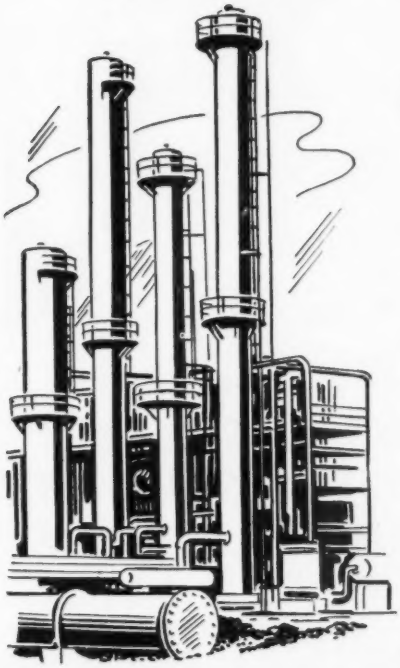
In addition to these five important features, the Republic Pneumatic Transmitter is extremely flexible in application, easy to service and of rugged construction.

If you have a flow, level, pressure or liquid density metering or control problem may we suggest that you investigate the Republic Pneumatic Transmitter? Data Book No. 1002, which contains complete details of this instrument, will be mailed to you upon request. Write for it today!

REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois

A "NATURAL" for GASOLINE PLANTS



. . . the *triple-thrifty*

Ingersoll-Rand Turbo-Blowers

- ✓ LOW IN POWER COSTS
- ✓ LOW IN MAINTENANCE
- ✓ HIGH IN AVAILABILITY

In Natural Gasoline Plants, Catalytic Cracking units, and wherever large volumes of air or gas must be compressed to moderate pressures, over 3,000,000 horsepower of Ingersoll-Rand Turbo-Blowers are repeatedly proving their economy and dependability.

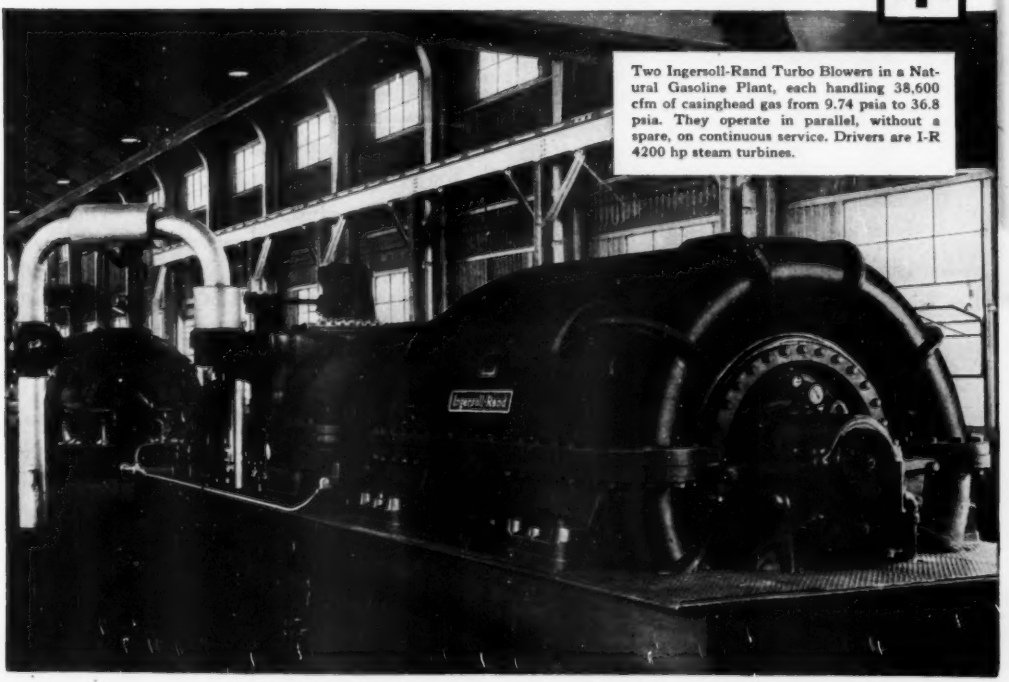
They save on *power costs* – through higher sustained efficiency, year after year. They save on *maintenance* – because they require less of it, even under the most severe operating conditions. And their high *availability* avoids costly shut-downs – keeps them earning money by maintaining maximum production.

Whatever your blower application, Ingersoll-Rand can design and supply the Turbo-Blower that's right for the job–a blower you can depend on for constant delivery of air or gas at the lowest cost. Sizes: to 21,000 hp, to 110 psig and higher, to 155,000 cfm.

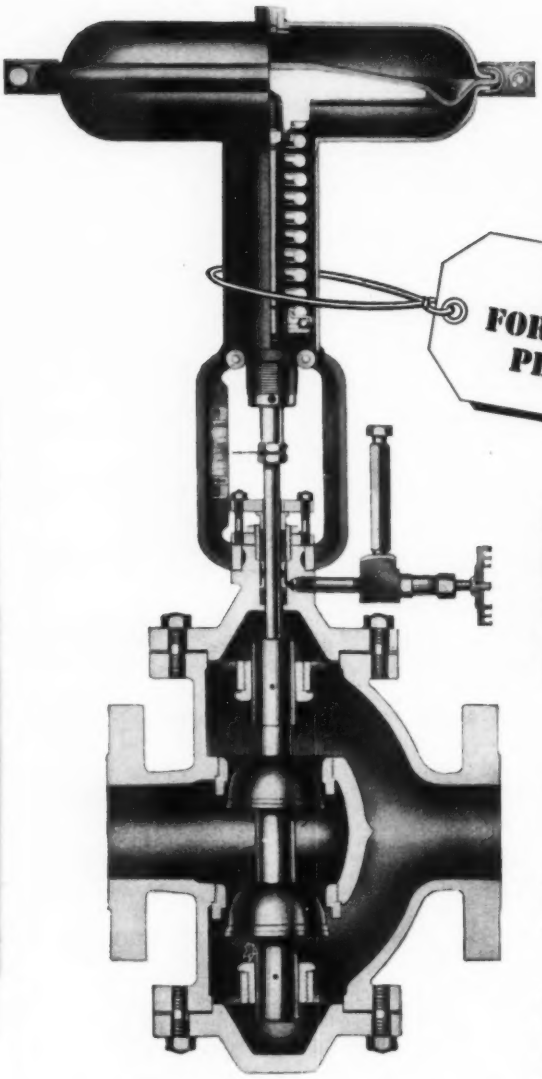
Ingersoll-Rand

11 Broadway, New York 4, N. Y. 553-12

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS • DIESEL & GAS ENGINES



Two Ingersoll-Rand Turbo Blowers in a Natural Gasoline Plant, each handling 38,600 cfm of casinghead gas from 9.74 psia to 36.8 psia. They operate in parallel, without a spare, on continuous service. Drivers are I-R 4200 hp steam turbines.



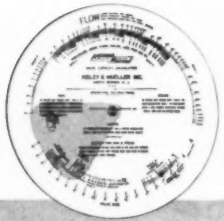
AMERICA'S LEADING INDUSTRIES PUT THE STAMP OF APPROVAL ON KIELEY & MUELLER CONTROL VALVES

Make It Your Business to Find Out Why!

All over the country leading companies in the process industries are solving tough problems with K & M control valves, designed especially for precise and positive control by instrumentation.

More and more, as the outstanding performance of these superbly engineered valves becomes known, important companies with pressure and flow applications are turning to K & M for the skill, knowledge and experience that assure reliable automatic control of pressures, temperatures, rates of flow and liquid levels.

There is a qualified K & M representative near you, eager to discuss your control problems and able to provide the most satisfactory solution.



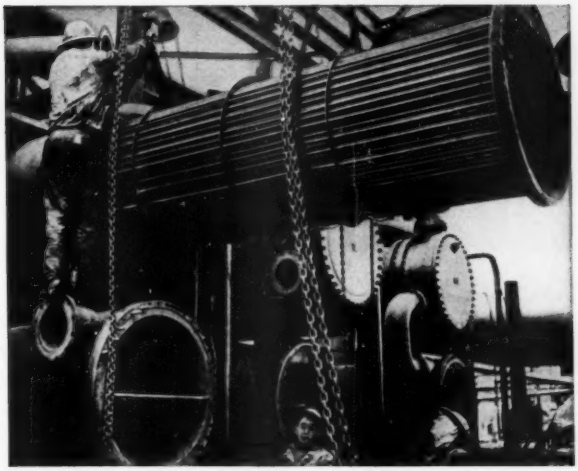
This extremely accurate circular slide-rule type K & M valve capacity calulator includes correction scales for steam quality, liquid and gas specific gravity and a flowing temperature scale for gases. Sent without charge in response to a request on your business stationery.

K&M

KIELEY & MUELLER, INC.

Valve Makers Since 1879

2033 - 43rd STREET NORTH BERGEN, N. J.



A cleaned exchanger tube bundle being replaced in its shell. "Spring-cleaning" like this prevents failures in service and insures efficient heat exchange. Photo courtesy The M. W. Kellogg Co., New York, N. Y.

For stronger, lighter, longer-lasting heat exchangers, you can depend on Monel

New interpretations of the A.S.M.E. Boiler Code have raised temperature limits on Inco Nickel Alloys.

Now it is possible to use stress-relieved corrosion-resisting Monel with its high mechanical properties for unfired pressure vessels operating at high temperatures.

Here's what one user discovered about Monel:

The tubes were exposed to straight run gasoline distillate on the shell side and a heavy re-cycle inside. The highest temperature was 550° F. Previous materials had failed after only 6665 hours. But Monel had a different story. After 22,000 hours, 24 tubes needed to be replaced. And at 38,535 hours, 3 tubes were plugged—*the remainder were still good for additional service!*

Compare the hours of service and you can easily see why Monel is first choice for long life.

Of course, with so much Monel and other Inco Nickel Alloys needed for defense, orders now take longer for delivery. But there are ways you can keep your production rolling even in times like these.

First, as you know, equipment should receive extra attention now so that trouble can be checked before it advances too far.

Secondly, anticipate your replacement requirements and order well in advance. *And be sure to include N.P.A. ratings* with full end use information. These precautions will help expedite your order.

And above all, keep in touch with your Warehouse and Service Center. They are anxious to help with all your metal problems. Remember, their knowledge of metals and availabilities may help you with tough production difficulties.

All the Warehouse and Service Centers listed here handle the Inco Nickel Alloys. Just write to the one nearest you — or better still, pick up the phone and call.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL
"S"® MONEL • NICKEL • LOW CARBON NICKEL
DURANICKEL® • INCONEL® • INCONEL "X"®
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WAREHOUSE SERVICE CENTERS

INCO NICKEL ALLOYS

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J. M. TULL METAL & SUPPLY CO.

BALTIMORE 5
WHITEHEAD METAL PRODUCTS COMPANY, INC.

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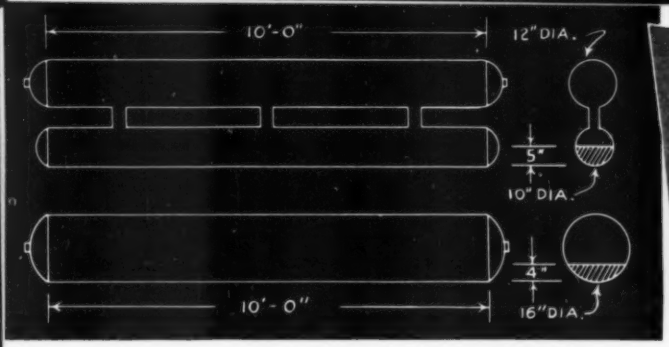
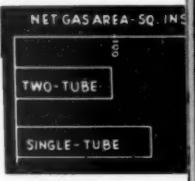


The Case in Favor of PARKERSBURG Single Tube Horizontal Separators

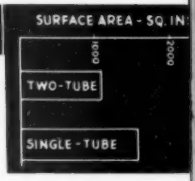
● The Parkersburg large Single Tube Horizontal Separator provides greater separating efficiency and other specific advantages over comparably priced double tube horizontal separators of equal nominal rating. These facts are substantiated by the accompanying area and capacity drawings of the two types of horizontal separators.

1. LARGE SINGLE TUBE PROVIDES GREATER AREA FOR GAS FLOW



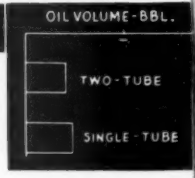
Reference to graph No. 1 shows the 16" single tube separator to have over 20% more gas area above the 4" fluid level than in the upper tube of the two tube separator. The velocity of gas in this larger area is therefore as much as 20% lower than in the top tube of the two tube separator. Consequently, separation of entrained liquid is more effective.

2. LARGE SINGLE TUBE HAS GREATER LIQUID SURFACE AREA



Our graph No. 2 shows the surface area is over 25% greater in the single 16" tube than in the bottom tube of the two tube separator with oil levels as indicated by the two cross-section drawings. As a result of this greater surface area, the oil comes into equilibrium more quickly and remains longer. Foam is more rapidly dissipated. Degassing of the oil is more thorough and complete under these conditions.

3. LARGE SINGLE TUBE PROVIDES LONGER RETENTION TIME



The volume of oil retained in the large single tube Parkersburg Horizontal Separator is greater, at any given rate of flow, than in the two tube separator. The retention time is therefore greater, giving the oil more time to give up its gas. This is particularly important where foam exists and a layer of foam on top of the oil interface retards liberation of gas from the oil.

Other specific advantages of the Parkersburg large Single Tube Horizontal Separator are: Retention of gas in same tube with oil keeps the oil warm, and therefore the water warm, so that Parkersburg Horizontal Separators withstand lower atmospheric temperatures without danger of water freezing. With the single tube, there is only one tube to clean out. This single tube has three drains, and is open all along the bottom for a depth of about 2", to provide a clear area for forcing out mud and accumulation.

Ask your Parkersburg Representative for additional data about Parkersburg Horizontal Separators — or write for latest bulletin.

No. 5205

PARKERSBURG
PRESSURE EQUIPMENT

HORIZONTAL AND VERTICAL SEPARATORS • HYRECO • HYDRACEPTER • SCRUBBERS • TREATERS • HEATERS

Manufactured in Houston, Texas

Who's Kidding Who?

YOU'RE kidding YOURSELF if you think every safety valve is equally safe.

We know of one case where inspection showed that 27 out of 36 safety valves were stuck tight—*would not have operated at pressures far above the set point*—yet the user of those valves *thought* he had protection. He *could* have been stuck right along with those 27 valves.

If you want 100 per cent safety—and you'd hardly want less—there's one sure way to get it—specify BalanSeal or FarriSeal Safety Valves.

Why?

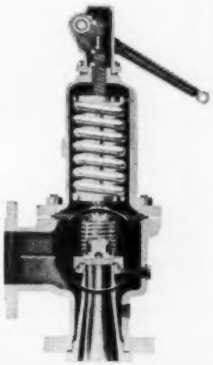
Because they *can't* stick, plug or corrode. Critical working parts are permanently isolated from any contact whatever with the lading.

Because they're unaffected by back pressures in the discharge manifold due to its own operation or to the opening of other valves in the line.

Because these features make it possible for you to use smaller discharge piping, an economy which often amounts to substantially more than the cost of the valves.

You'll be interested in the engineering of BalanSeal and FarriSeal Valves—design which is rapidly gaining acceptance in hundreds of successful installations.

Ask for our "8-Minute Brief."



Your Safety's REAL With FarriSeal

1189

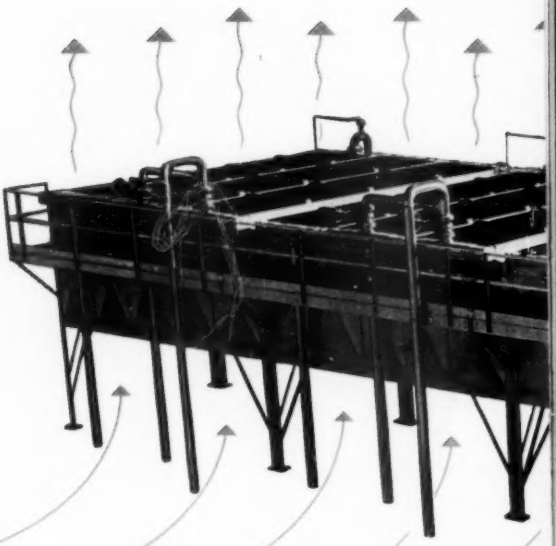
Farris ENGINEERING CORP.

412 COMMERCIAL AVE., PALISADES PARK, N. J.

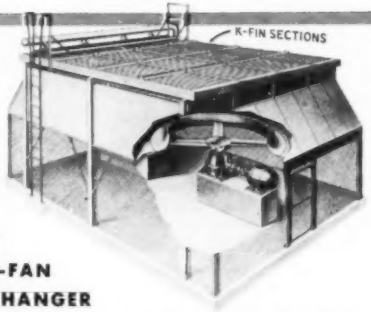
AFFILIATES

Farris Stocon Corp. *Temperature Regulators* • Farris Flexible Valve Corp. *Pinch Type* • Farris Hydrotorque Corp. *Remote Controls* • Farris Hydroseal Corp. *Elastic Piston Seals*

"Give it the air ...."



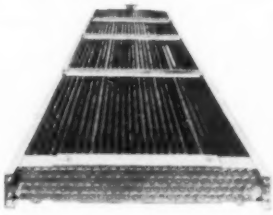
now means cool or condense



THE FIN-FAN EXCHANGER

This "package-type" unit, developed jointly by Griscom-Russell and Fluor Corp., Ltd., is adaptable to practically every condensing and cooling service, especially when the use of cooling water involves problems of supply, cost, scale, corrosion, or other difficulties.

It may be placed in any convenient location, operates independently of wind velocity and direction, and is simple and economical to operate and maintain.



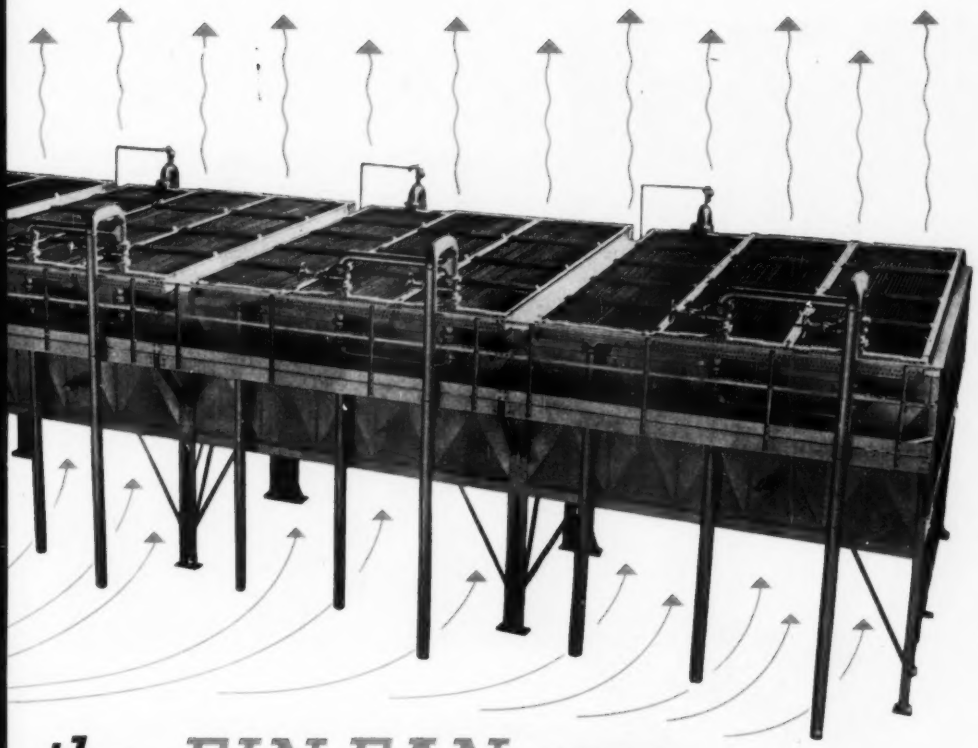
K-FIN AIR-COOLED SECTIONS

The helical-fin extended surface of these sections provides a cooling or condensing surface that has eleven times the external area of bare tubes of the same length and tube diameter. Thus, the sections provide large heat transfer duty in a very compact unit.

These sections are of extremely sturdy construction, and can be furnished to withstand pressures up to 5000 psi and temperatures up to 1500F.

GR 267A

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO



the FIN-FAN way

Air . . . not water . . . does the cooling or condensing in a Fin-Fan Heat Exchanger.

That means freedom from all water system complications, expenses and troubles.

But that's only one of the many Fin-Fan benefits. With Fin-Fan, you get the superior heat transfer of the exclusive K-Fin helical cooling elements, you can handle several different duties in a single installation, and you get an exceptionally sturdy rugged unit suitable for high pressures and temperatures, and of proven effectiveness and economy of operation and maintenance.

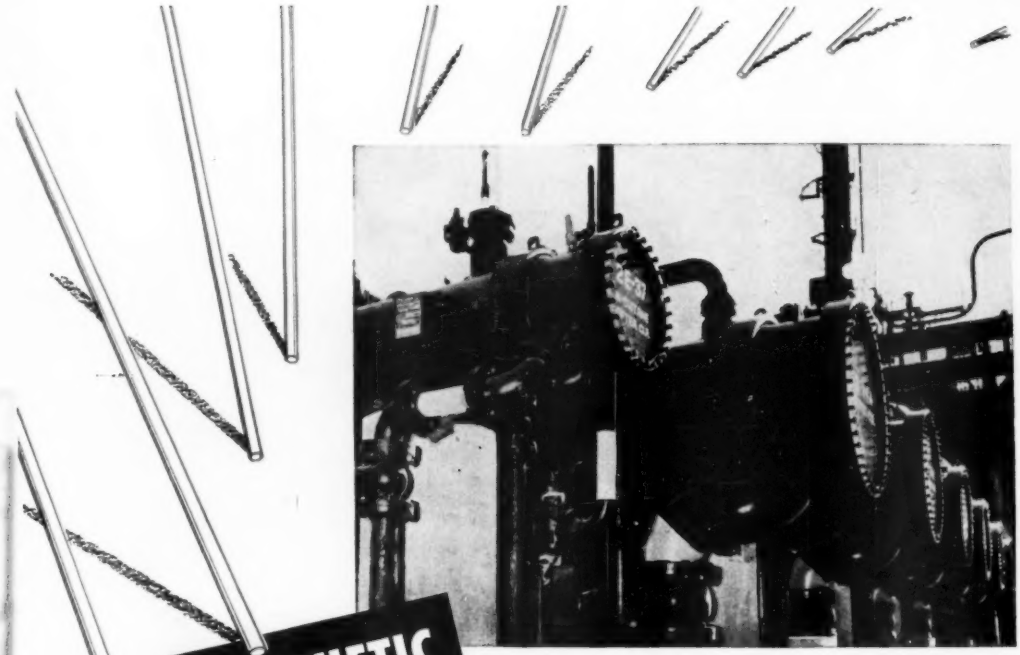
These advantages explain why so many plant engineers are saying "Give it the air—with Fin-Fan" when they want a cooler or condenser. Investigate Fin-Fan possibilities for *your* plant. Write for full information without obligation.

Some Services on which Fin-Fan is widely used

- Still reflux condensing
- Final overhead condensing and cooling
- Process gas cooling
- Solution cooling
- Gas compressor inter and after cooling
- Lube oil cooling
- Jacket water cooling
- Exhaust steam condensing
- Gas treating system cooling and condensing

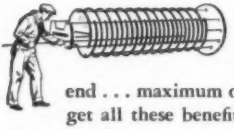
GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS



SYNTHETIC RUBBER

...another industry that uses HUNDREDS OF MILES of REPUBLIC ELECTRUNITE PRESSURE TUBES



Uniform strength *all around the tube* at elevated operating temperatures . . . uniform corrosion resistance *all around the tube* and from end to end . . . maximum on-stream service helps lower annual cost . . . you get all these benefits when you retube with Republic ELECTRUNITE Pressure tubes . . . or specify them for new heat exchangers.

Whatever your products . . . whether you require carbon steel or stainless steel tubes . . . let us tell you why you'll get more hours of production with less down-time and lower cost per year from Republic ELECTRUNITE Heat Exchanger Tubes . . . they're proved by millions of hours of service—in thousands of heat exchangers and condensers in scores of industries.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
224 East 131st Street • Cleveland 8, Ohio

REPUBLIC STEEL

Republic ELECTRUNITE

We're proud of the company we keep

ALCOA is proud of the company it keeps in the petroleum and petrochemical industries, of which these good names are but a few. These companies, like so many others, have found that ALCOA Chemicals make "good partners for good products."

Remarkably versatile ALCOA Aluminas and Fluorides have gone hand-in-hand with the Industry's progress—increasing production, improving quality and reducing costs.

For instance, there's an ALCOA Activated, Tabular or Calcined Alumina to upgrade your catalytic process yields and reduce losses from contamination and side reactions.

Or perhaps you have a bed-support or cover problem. ALCOA Tabular Alumina Balls are chemically and thermally stable, and catalytically neutral. They offer economy, adaptability and better operation of your reactor towers.

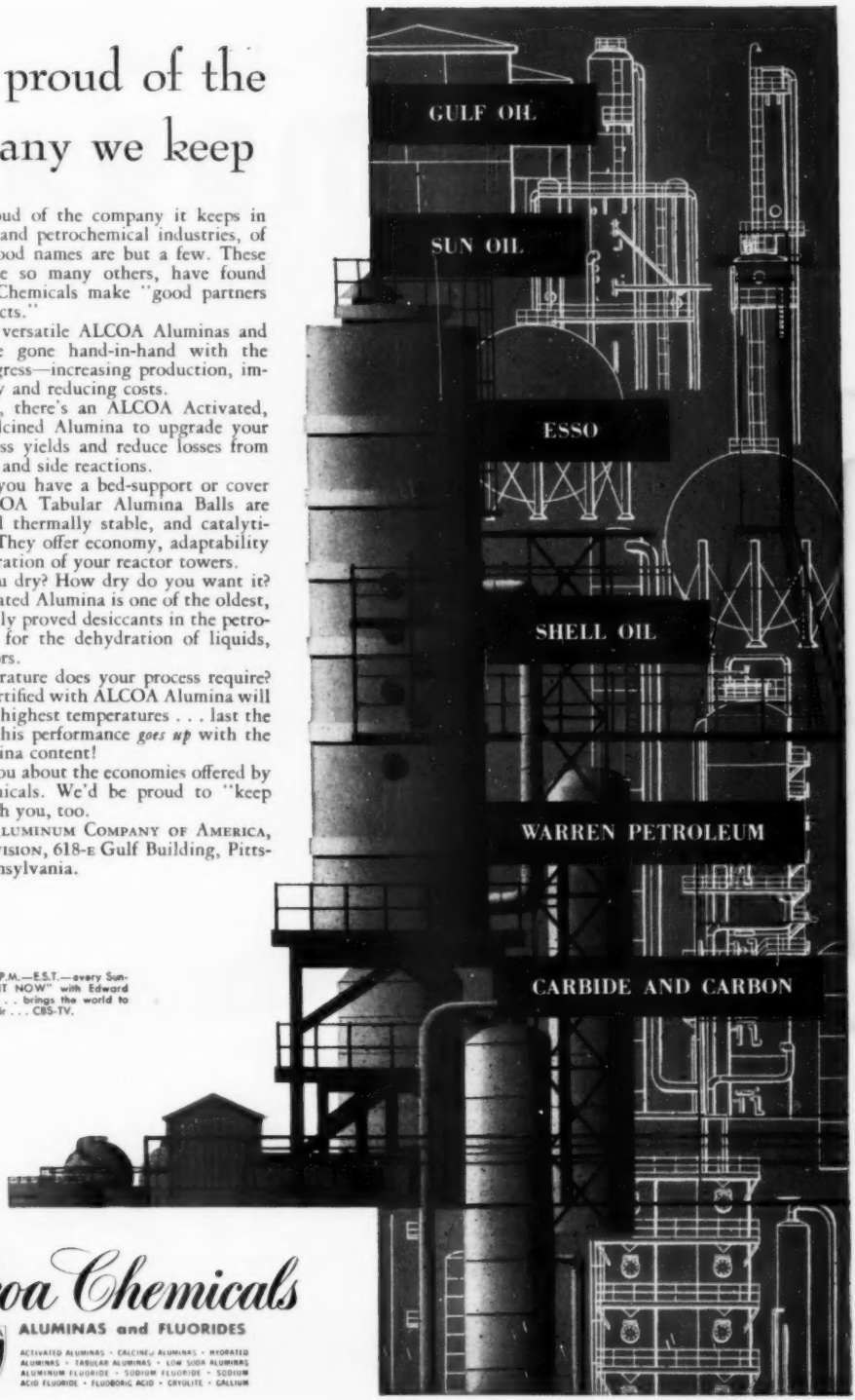
What do you dry? How dry do you want it? ALCOA Activated Alumina is one of the oldest, most thoroughly proved desiccants in the petroleum industry for the dehydration of liquids, gases and vapors.

What temperature does your process require? Refractories fortified with ALCOA Alumina will withstand the highest temperatures . . . last the longest. And this performance *goes up* with the ALCOA Alumina content!

Let us tell you about the economies offered by ALCOA Chemicals. We'd be proud to "keep company" with you, too.

Write to: Aluminum Company of America, Chemicals Division, 618-E Gulf Building, Pittsburgh 19, Pennsylvania.

NOW 6:30 P.M.—E.S.T.—every Sunday—"SEE IT NOW" with Edward R. Murrow . . . brings the world to your armchair . . . CBS-TV.



Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

MARSH

. . . the gauge with the "Recalibrator"

Any pressure gauge can be knocked out of adjustment, but when it's a Marsh Gauge you can quickly correct it with the twist of the "Recalibrator" screw.

This is not only the handiest way to correct a gauge; it is also the best way. Conventional methods of adjustment simply compensate for the error. The "Recalibrator" corrects the relationship between the movement and the bourdon tube—actually *does re-calibrate* the gauge.

MARSH INSTRUMENT CO. Affiliate of James P. Marsh Corp. Dept. L. SKOKIE, ILL.

Export Dept.: 155 E. 44th St., New York 17, N. Y.

The Marsh line includes gauges especially designed for blenders, boilers, burners, capping, Christmas trees, columns, heaters, hydrogen units, instrument panels, pumps, Reid vapor bombs, scrubbers, separators, mud pumps, stills, towers and other applications including oxygen and welding gauges. Ask on your letterhead for new catalog just off the press.

GREATER RIG DEPENDABILITY

—with dependable SKF bearings!

Unit Rig and Equipment Company's new Model U-20 Drawworks, with a 1,000 hp input, is adaptable for drilling from 7,500 to 12,000 feet, using 4½" drill pipe. It's portable, easy to operate, and a *mighty dependable worker!* Contributing to Model U-20's dependability—keeping friction at the minimum—are SKF Bearings at strategic locations. Unit Rig and Equipment Company selected SKF Spherical Roller Bearings because of their proven performance for trouble-free operation . . . their high load-carrying capacity . . . their stamina for shock loads . . . their self-aligning features. Here again, one more item of proof that SKF helps the Oil Industry to put the right bearing in the right place.

7320

SKF®
BALL AND ROLLER BEARINGS

8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

integrity • craftsmanship • metallurgy
tolerance control • surface finish • product uniformity
engineering service • field service

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.—*manufacturers of* SKF *and* HESS-BRIGHT *bearings.*

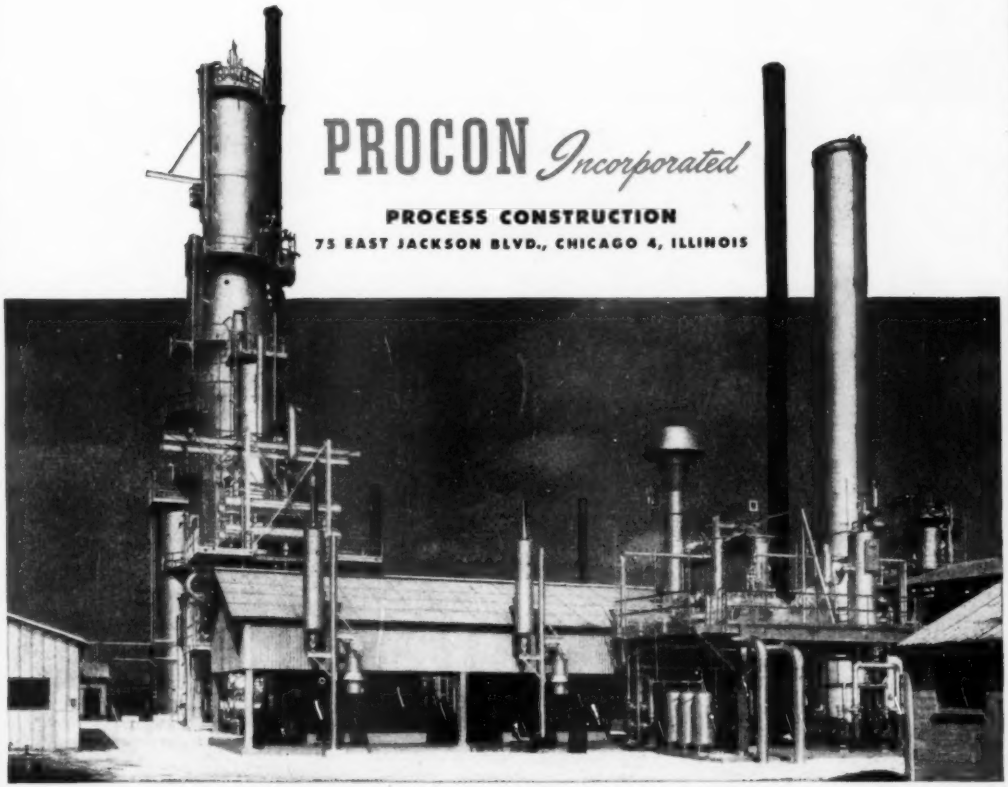
NEW FLUID CAT CRACKER....

for THE BAY PETROLEUM CORPORATION
Chalmette Refinery . . .

BUILT BY PROCON

Completed within nine months, this 5600 b/d UOP Fluid Catalytic Cracking Unit was built by Procon for The Bay Petroleum Corporation, Chalmette (La.) refinery with less than 30 days' interruption in plant operations. Shut-down time was minimized by fast work in converting existing equipment to use with the new cracker.

While this new unit was still under construction, Bay Petroleum placed an order with Procon for a second UOP fluid cat cracker to be built at their Denver refinery. Such confidence is convincing evidence of Procon's ability and facilities to handle any refinery or petro-chemical plant construction job.



PROCON *Incorporated*

PROCESS CONSTRUCTION

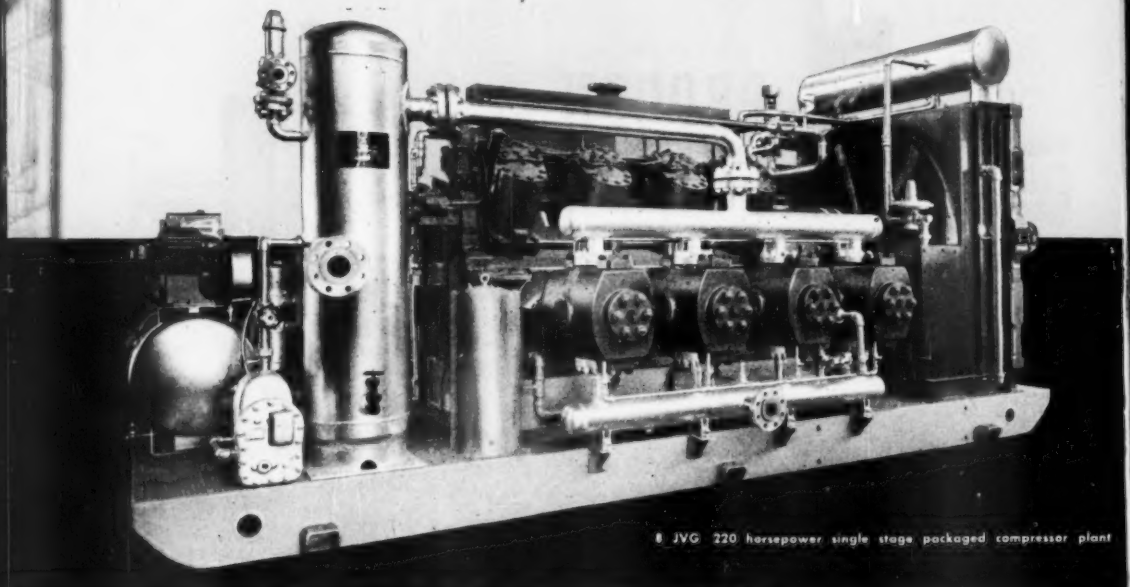
75 EAST JACKSON BLVD., CHICAGO 4, ILLINOIS

Lights Out ON THE FLARE STACKS

Flare Gas Has Gone To Work

Gas flares, which formerly marked oil and gas fields, are becoming a thing of the past. The gas which fed the flares has been put to work, in gas lift operations, gas distribution pipelines and secondard recovery systems. A major contribution to this utilization of flare gas has been made by the development of Beaird-Ingersoll-Rand packaged compressor plants. These are *complete plants — completely packaged.* They are specifically designed to meet the requirements of a portable field compressor station which is easy to install — simple to operate — adaptable to changing field conditions — and which can be moved to new locations with minimum re-installation expense. Today, over two hundred Beaird-Ingersoll-Rand packaged compressor plants, with a total of over one-half million horsepower, are in operation in fields from coast to coast.

Let us send you our new booklet on the Beaird-Ingersoll-Rand packaged compressor plant.



8 JVG 220 horsepower single stage packaged compressor plant

THE J. B. BEAIRD COMPANY, INC. SHREVEPORT, LOUISIANA

L.P.G. SYSTEMS

CAST STEEL FITTINGS

ANHYDROUS AMMONIA EQUIPMENT

PRESSURE BULK STORAGE

MACHINING
FABRICATING

SINCE 1918
BEAIRD
SHREVEPORT

LOWEST COST PER HORSEPOWER INSTALL

They Say—

Politics First in Iran

"Mr. Mossadegh admits that his country is in an economic quagmire. But instead of reopening the oil industry with the aid of either the former British operators or the International Bank for Reconstruction and Development, which has offered its services, he insists on putting politics first.

"He not only refuses every compromise that would solve his country's financial problem but also attempts to shift the blame from himself to others, in particular Britain and the United States.

"For the moment he has a subservient new Parliament to back him up in his folly, but his arguments are wearing thin and his desperate measures are arousing a degree of opposition which offers hope that more reasonable elements will in the end come to the fore to save the nation."

Editorial in the New York Times.

Handicap of Government

"Government has extended its controls and restrictions to the point that all phases of American business operate under severe handicaps of rules and regulations. Some controls may be necessary in time of war. Unfortunately, the tendency is to continue so-called temporary controls long after the need for them has passed, until they acquire the aspect of permanency.

"Government contributes no capital, no working tools. It accepts no risks—but demands and receives an ever-mounting portion of business earnings. Stockholders are expected to venture their capital though confronted by diminishing rewards. If there are losses the stockholder must shoulder them. Unless this trend is stopped and reversed, the entire economic system of this country faces destruction."

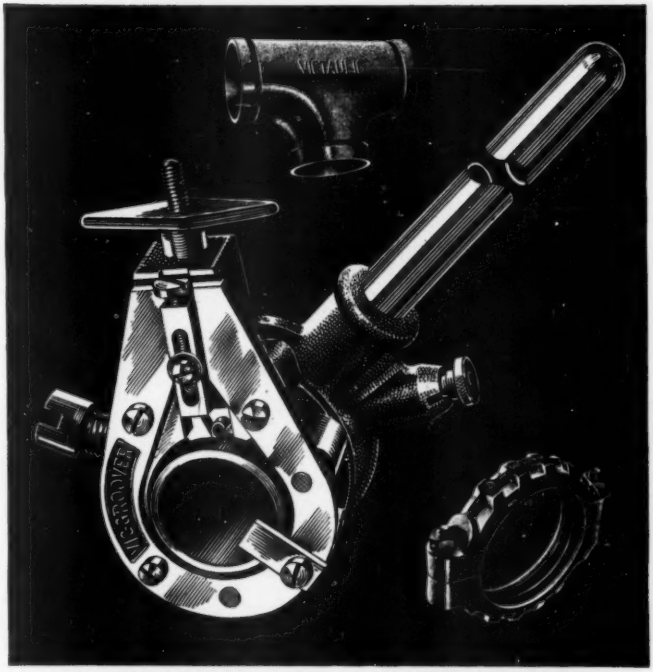
Annual Report, Cities Service Oil Co.

What's Behind Competition

"The obvious lack of understanding of keen gasoline price competition which has recently marked the public consciousness, accompanied in some instances by cries for government action, indicates to us a need for a reiteration of faith in the principles underlying such competition.

"We believe that competition is the only effective regulator of economic enterprise and that it is the only true guarantor of efficient public service

THE VICTAULIC METHOD OF PIPING



EASIEST WAY TO MAKE ENDS MEET

"Vic-Groover" Tools save time, save money, are an important feature of the famous Victaulic Method. These portable, easy-to-operate pipe groovers prepare pipe ends easily and quickly right on the job to receive Victaulic Couplings and Fittings!

The *complete* Victaulic Method comprises: easy-to-install Victaulic Couplings for assured leak-proof connections and a union at every joint . . . a complete line of Full-Flow Elbows, Tees, Reducers, and other modern Fittings that offer wide adaptability and versatility . . . and, of course, unique, fast-working "Vic-Groover" Tools.

Why not give the Victaulic Method a tryout on *your* next piping job? You'll find that mis-alignments, expansion and contraction are automatically taken care of with Victaulic and you'll have assured lock-joint, leak-proof piping!

For new construction . . . repairs . . . alterations, use the VICTAULIC METHOD . . . *it's the easiest way to make ends meet!*

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Union, N. J.
Telephone: Elizabeth 4-2141

28th VICTAULIC YEAR

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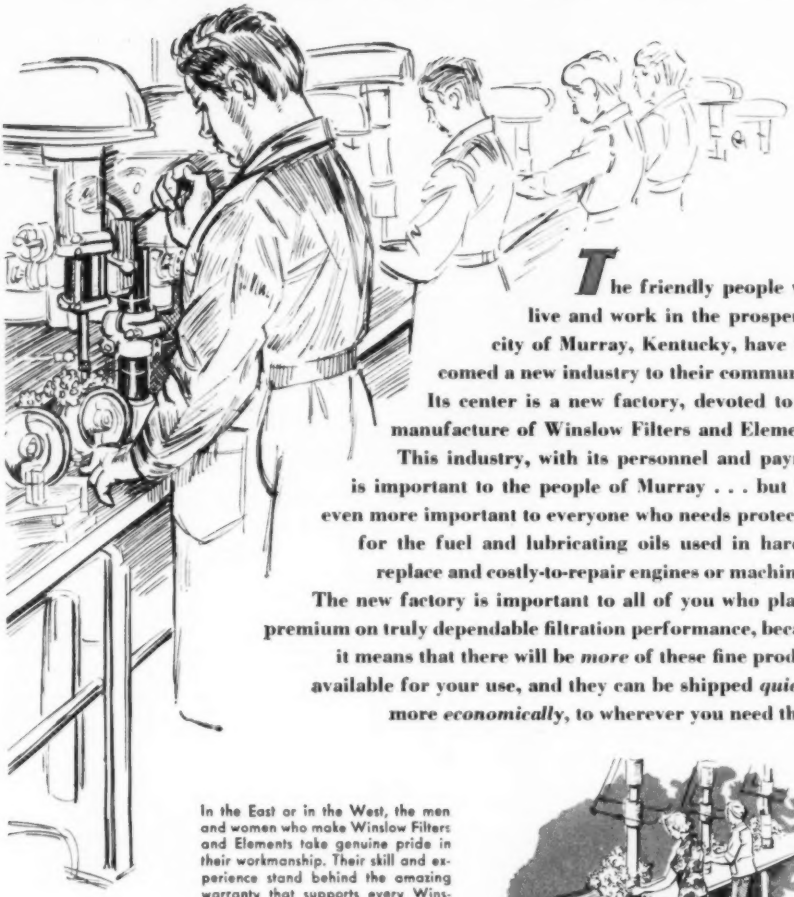
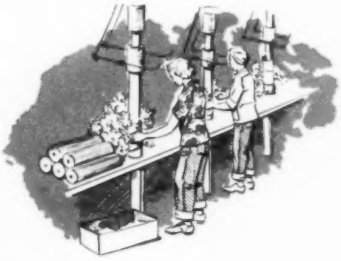
Canada: Victaulic Co. of Canada Ltd., 406 Hopewell Ave., Toronto 10
Export: Pipe Couplings, Inc., 30 Rockefeller Plaza, N. Y. 20, N. Y.

A New Winslow Factory For Faster Service



The friendly people who live and work in the prospering city of Murray, Kentucky, have welcomed a new industry to their community. Its center is a new factory, devoted to the manufacture of Winslow Filters and Elements. This industry, with its personnel and payroll, is important to the people of Murray . . . but it is even more important to everyone who needs protection for the fuel and lubricating oils used in hard-to-replace and costly-to-repair engines or machinery. The new factory is important to all of you who place a premium on truly dependable filtration performance, because it means that there will be *more* of these fine products available for your use, and they can be shipped *quickly*, more *economically*, to wherever you need them!

In the East or in the West, the men and women who make Winslow Filters and Elements take genuine pride in their workmanship. Their skill and experience stand behind the amazing warranty that supports every Winslow product. Ask for full details!



WINSLOW FILTERS

Winslow Engineering Company 4069 Hollis Street, Oakland 8, California

—providing people with the commodities and services they want at prices which they are both able and willing to pay.

"What is more, we believe that competition is the indispensable protector of not only economic freedom but of all American freedom and opportunity. The sole alternative to competition is a government-directed economy. Such a substitute for the competitive market place eventually would end all freedom, leaving to the individual nothing but the necessity of obeying authoritarian decrees controlling all his activities."

Annual report of Sun Oil Co.

CALENDAR

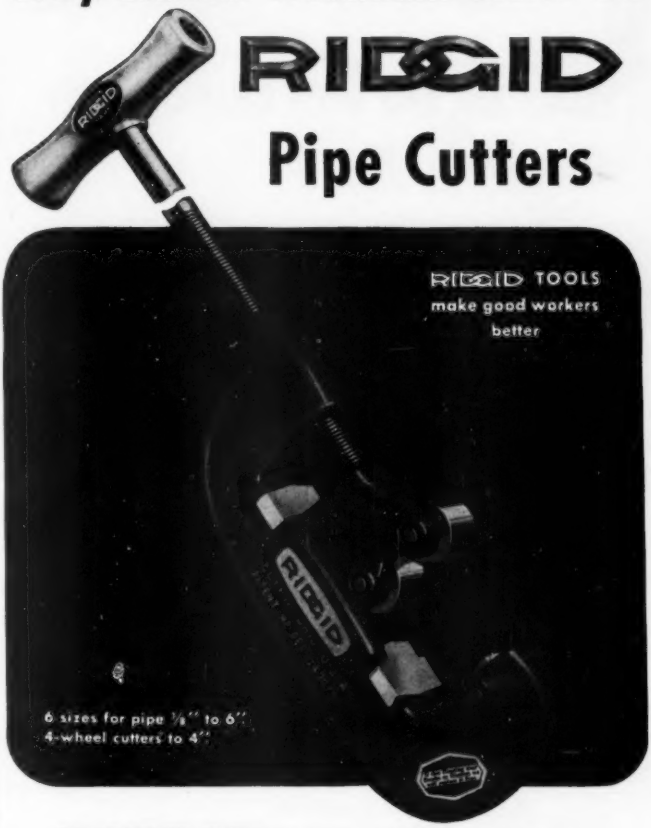
MAY

8- 9	Texas Petroleum Research Committee, Fourth Oil Recovery conference, Austin, Tex.
8-10	Geological Society of America, Rocky Mountain section, University of Utah, Salt Lake City.
9-10	Interstate Oil Compact Commission, spring meeting, Phoenix, Ariz.
11-14	American Institute of Chemical Engineers, regional meeting, French Lick, Ind.
12-13	American Association of Petroleum Geologists, regional meeting, Mayo Hotel, Tulsa.
12-13	American Gas Association, Natural Gas Department, spring meeting, Biltmore Hotel, Los Angeles.
12-14	Annual Liquefied Petroleum Gas Association convention and trade show, Palmer House, Chicago.
12-15	American Petroleum Institute, division of refining, seventeenth midyear meeting, St. Francis Hotel, San Francisco.
13-15	Pennsylvania Gas Association, Wernesville, Pa.
15-16	American Petroleum Institute, Division of Production, Pacific Coast district, Biltmore Hotel, Los Angeles.
16	University of Kansas City, symposium on oil and gas, Kansas City.
16-18	Appalachian Geological Society and the Oil and Gas Section of the Engineers' Society of Western Pennsylvania, joint meeting, Morgantown, W. Va.
17	Permian Basin Geophysical Society, first annual meeting, Scarborough Hotel, Midland, Tex.
19-20	American Petroleum Institute, Division of Marketing, midyear meeting, Sheraton-Plaza Hotel, Boston.
19-20	American Association of Oilwell Drilling Contractors, seventh annual safety clinic, Adolphus Hotel, Dallas.
21-23	Gas Appliance Manufacturers Association, annual meeting, Broadmoor Hotel, Colorado Springs, Colo.
26-28	American Gas Association, production and chemical conference, Hotel New Yorker, New York.
27-28	American Petroleum Institute lubrication committee, Mayo Hotel, Tulsa.
27-29	Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.
28-30	Seventh annual short course in gas technology, sponsored by the Southern Gas Association, Texas College of Arts and Industries, Kingsville, Tex.

Why Skilled Workmen Insist On

RIDGID

Pipe Cutters



RIDGID Heavy-Duty Cutters assure you extra quick easy pipe cutting

★ High alloy thin-blade cutter wheels roll quickly through pipe with least effort—clean, almost burrless cuts.

★ Special malleable housing guaranteed warp-proof, assures perfect tracking of cutter wheel—every tool factory tested.

★ Efficiency-balanced design for quick easy work—made for long hard service.

★ Order from your Supply House.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools

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Costly plug cleaning, with its high labor bills and lengthy equipment down-time, goes out of the condenser and heat exchange picture the minute chlorination arrives.

This proven process for cutting the costly effects of back pressure and poor heat transfer characteristics caused by slime, really works, as one Southern Power Station found out when they began using the W&T De-sliming Process.

In just six months after W&T Chlorinators were installed, cleaning and excess steam costs were reduced from $1450 per month to $250 per month and a later survey showed an overall saving in excess steam costs of $16000 in a year.

Such savings are indicative of how your condensers may be made to operate more economically and with far less outage when W&T Engineers install chlorination to fight your slime problems.

To learn how chlorination may be profitably applied to your heat exchange equipment and to take advantage of W&T's 35 years' experience, write today.

WALLACE & TIERNAN PRODUCTS, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

Belleville 9 New Jersey

Represented in Principal Cities

CD-31

29-30	Society of Exploration Geophysicists, Gulf Coast regional meeting, Rice Hotel, Houston.
JUNE	
1- 6	Society of Automotive Engineers, summer meeting, Ambassador and Ritz-Carlton hotels, Atlantic City, N. J.
2- 4	Seventh annual short course on process instrumentation, A. & M. College of Texas, College Station.
5- 6	Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh.
5- 7	National Oil Scouts and Landmen's Association, annual convention, Hilton Hotel, Albuquerque, N. M.
7	California Natural Gasoline Association, annual June Frolic, Rio Hondo Country Club, Downey, Calif.
8-12	Canadian Gas Association, Chateau Frontenac, Quebec.
9-14	American Petroleum Institute, midyear standardization meeting, Brown Palace Hotel, Denver.
12-13	Western Petroleum Refiners Association, regional technical and industrial-relations meeting, Broadview Hotel, Wichita.
13-14	Rocky Mountain Oil and Gas Association, midyear meeting, Rainbow Hotel, Great Falls, Mont.
16-22	International Gas Conference, Brussels, Belgium.
19-20	Kentucky Oil and Gas Association, annual meeting, Hotel Lafayette and Phoenix Hotel, Lexington, Ky.
22-25	Petroleum Equipment Suppliers Association, Mark Hopkins Hotel, San Francisco.
23-24	Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich.
23-27	American Society for Testing Materials, annual meeting, Hotel Statler, New York.
23-27	American Institute of Electrical Engineers, summer general meeting, Nicollet Hotel, Minneapolis.
AUG.	
1- 3	Wyoming Geological Association, field trip, Big Horn basin.
11-13	Society of Automotive Engineers, national West Coast meeting, Fairmont Hotel, San Francisco.
19-22	American Institute of Electrical Engineers, Pacific general meeting Westward Ho Hotel, Phoenix, Ariz.
25-27	Twelfth Annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.
SEPT.	
3- 5	Pacific Coast Gas Association, Ambassador Hotel, Los Angeles.
8-12	Instrument Society of America, seventh national instrument conference and exhibit, Cleveland.
10-12	National Petroleum Association, fiftieth annual meeting, Hotel Traymore, Atlantic City, N. J.
11-13	American Institute of Chemical Engineers, regional meeting, Palmer House, Chicago.
25-26	Western Petroleum Refiners Association, regional meeting, Hotel Henning, Casper, Wyo.
28-30	American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.
OCT.	
1-3	National Association of Corrosion Engineers, South Central section, technical program and committee meetings, Jung Hotel, New Orleans.
1- 3	American Institute of Mining and Metallurgical Engineers, Mid-Continent fall meeting, petroleum branch, Rich Hotel, Houston.

THE WORLD LEADER

Three barrel-shaped cutters contact over one-third wall circumference — acting simultaneously as cutters and as large roller bearings. Unexcelled for reaming, directional drilling, minimizing keyseating, stabilizing, etc. All sizes.

FOR STABILIZING OR REAMING — SECURITY REAMERS *LEAD THE FIELD*

A Security Reamer-Stabilizer in your drill string is your greatest assurance of a clean, straight, full-gauge hole.

Security's 22 years of successful laboratory research and development, combined with practical field engineering and experience, has gained for Security Reamers their leading position in reaming and stabilizing.

Whether it's reamers, rock bits, hole openers or casing scrapers — Security products are geared to the stepped-up requirements of today's intensified drilling efforts, and are being used by operators throughout the world.

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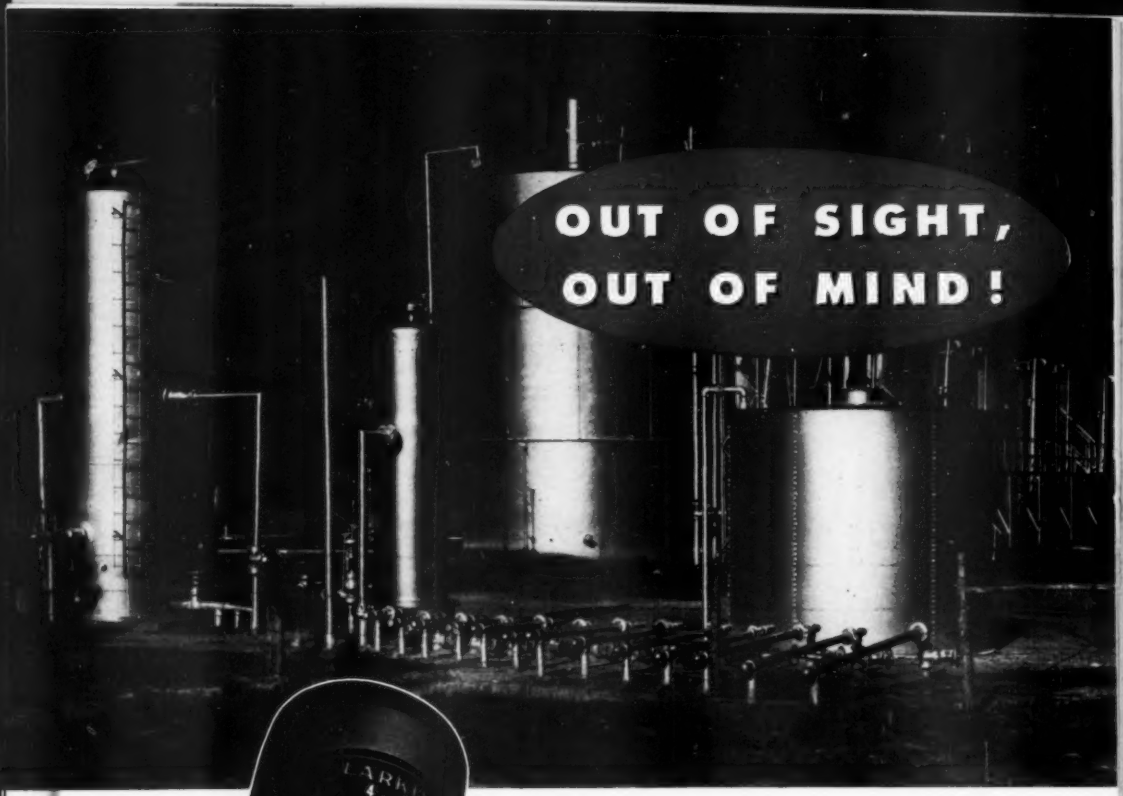
S12-3



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...Through Your Supply Store

• In installations like these, often more swage nipples and bull plugs are used underground than above. When Larkin fittings are specified, they can be buried and forgotten because they are well protected against corrosion and have a generous safety factor. Thousands have given satisfactory service for years in underground hook ups.

Larkin Swage Nipples and Bull Plugs are Zincoted inside and out to protect against corrosion; they are of seamless and weldless construction and made of quality steel. They have square faced ends and accurate threads, with a bevel for easy starting.

Underground or above, wherever swage nipples and bull plugs are needed, your best buy is Larkin. You'll find every size and style you need ". . . Through Your Supply Store."

LARKIN PACKER CO., INC.
ST. LOUIS, MO.

2- 3	Petroleum Electric Power Association, twenty-third annual meeting, Mayo Hotel, Tulsa.
6	Independent Natural Gas Association of America, annual meeting, Fontenelle Hotel, Omaha, Neb.
9-10	California Natural Gasoline Association, twenty-seventh annual fall meeting, Ambassador Hotel, Los Angeles.
13-15	Texas Mid-Continent Oil and Gas Association, thirty-third annual meeting, Hotel Texas, Fort Worth.
13-17	American Institute of Electrical Engineers, fall meeting, New Orleans.
16-19	Permian Basin Oil Show, Odessa, Tex.
19	Natural Gasoline Association of America, southern regional meeting, Blackstone Hotel, Tyler, Tex.
20-21	Independent Petroleum Association of America, annual meeting, Mayo Hotel, Tulsa.
22-24	Society of Automotive Engineers, national transportation meeting, Hotel William Penn, Pittsburgh, Pa.
23-24	American Institute of Mining and Metallurgical Engineers, West Coast fall meeting, petroleum branch, Statler Hotel, Los Angeles.
27-31	American Gas Association, annual convention Atlantic City, N. J.
30-Nov. 1	Rocky Mountain Oil and Gas Association, annual meeting, Cosmopolitan Hotel, Denver.

NOV.

3- 4	Society of Automotive Engineers, national diesel engine meeting, Chase Hotel, (tentative), St. Louis, Mo.
6- 7	Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.
6- 8	Gulf Coast Association of Geological Societies, annual fall meeting, Hotel Driscoll, Corpus Christi, Texas.
8-13	Oil Industry Information Committee, Conrad Hilton Hotel, Chicago.
10-13	American Petroleum Institute, thirty-second annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.
13-14	Society of Exploration Geophysicists, midwestern meeting, Texas Hotel, Fort Worth.
20-22	Instrument Maintenance Short Course, jointly sponsored by Southern California Meter Association and Los Angeles Harbor Junior College.
30-Dec. 5	American Society of Mechanical Engineers, Statler Hotel, New York City.

DEC.

7	Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex.
7-10	American Institute of Chemical Engineers, annual meeting, Hotel Cleveland (Hqs.) and Carter Hotel, Cleveland.

NOMADS

Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

Dallas-Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month, Ye Ole College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month, Jonathan Club.

REPUBLIC NATIONAL BANK
OF DALLAS, TEXAS

Statement of Condition, March 31, 1952

RESOURCES

Cash and Due from Banks	$151,132,320.59
U. S. Government Securities	57,276,238.50
State, Municipal and Other Securities	2,821,274.86
Stock in Federal Reserve Bank	1,275,000.00
Loans and Discounts	218,064,506.34
Bills of Exchange and Commodity Loans	20,179,196.43
Real Estate — New Building and Equipment	5,199,238.00
Acceptances — Customers Account	10,938,653.92
Total	$466,886,428.64

LIABILITIES

Capital	$ 21,000,000.00	
Surplus	21,500,000.00	
Undivided Profits	4,868,105.40	47,368,105.40
Reserve for Monthly Dividend, Payable April 1, 1952		199,500.00
Reserve for Contingencies		3,518,970.49
Reserve for Taxes, Etc.		2,828,621.91
Acceptances — Customers Account		11,163,653.92
Deposits:		
Individual	264,481,005.94	
Banks	117,036,835.80	
Government	20,289,735.18	401,807,576.92
Total		$466,886,428.64

☆ ☆ ☆

Assets of the Republic National Company, with capital stock of $3,000,000, are not included in above statement. The Company owns controlling stock in the following banks located in Greater Dallas, all affiliated with Republic National Bank:

FAIR PARK NATIONAL BANK — LAKEWOOD STATE BANK
GREENVILLE AVENUE STATE BANK — NATIONAL CITY BANK
HIGHLAND PARK STATE BANK — OAK CLIFF BANK & TRUST CO.
OAK LAWN NATIONAL BANK

Resources of the Republic National Bank and Affiliated Banks aggregate $578,847,089.43

"My Bank" ...the strong, friendly bank

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

THE CARE AND NURSING OF TANK CARS

Set the brakes...

lock the wheels...

save the load.

Another way to get more from your GATX tank cars

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GENERAL AMERICAN TRANSPORTATION CORPORATION

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THE OIL AND GAS
JOURNAL
TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa, Oklahoma. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

•

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•

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JOURNALLY Speaking

Field Processing

ASK a layman what "field processing" might mean, and he probably would guess it is something like a farmer canning vegetables right in the plot where he grew them instead of shipping them off to factory. And that wouldn't be too far off from a good analogy of field processing in the petroleum industry.

Field processing does mean "canning" petroleum products right where they are produced—not literally putting them up in tins, but separating various petroleum products from the crude-oil "crop" and preparing them for market.

This field processing has come to be big business, virtually an industry within an industry. The plants aren't refineries in the ordinary sense and yet some of them are larger and more intricate than a lot of refineries. Field processing started many years ago with what was called drip gasoline, then casing-head gasoline, then natural gasoline. Now even that term is inadequate to cover the wide variety of products and processes of these field plants.

So our favorite oil publication decided to haul off and pick a name based on function rather than product, which is why this is our annual Field Processing Number.

Handy Maps

STUCK into this issue is—or was when it left our shop—a map showing the locations of natural-gasoline and cycling plants in the United States, with a table showing the capacity of each. It is based, in part, on information from the elaborate brochure on petroleum transportation recently issued by the Petroleum Administration for Defense, but with additional and more current data compiled by our own statistical department.

That PAD report also supplied the base material for three other maps which subscribers to the Big Yellow Book will be getting soon. In the May 19 issue will be a map and chart showing the estimated future ability of the various regions of the country to produce crude oil and natural-gas liquids. The map in the June 2 issue will give the locations and capacities of refineries, and in the June 23 issue will be a reproduction of the fancy PAD map which shows producing capacity, refining capacity, and transportation capacity, by regions.

These four maps are smaller than a good many we have distributed, which makes them mighty handy to keep on the wall or in a desk drawer for quick reference. So latch on to the field-processing map in this issue and watch for the others as they come along. No extra charge to regular customers. Just part of the usual Journal service.

And speaking of maps, we have had a lot of compliments on that big map and geological chart of major oil basins which accompanied our March 24 issue—and also a lot of orders for extra copies. We still have some in stock, however, which we are willing to part with at two simoleons per throw, so if you want another copy while the supply lasts you know what you can do.

Extra Ideas

DID you notice the ad on the front cover of our favorite oil publication last week? Timken Roller Bearing used the space to put in a generous plug for all its fellow advertisers—competitors and customers alike. Of course it wasn't completely altruistic, because it got people to read Timken's ad and suggested that oil men ought to read all Journal ads regularly, including those Timken will be running in the future.

What we liked about it was the thought that our advertisements contain extra ideas, in addition to all the valuable information crammed into the editorial pages. Now and then some subscribers assert that they can hardly find our editorial material because of the ads, but we believe that they are trying to needle us and that they would sorely miss the ads if they weren't there.

On the other hand, a much larger number tell us that the ads are the best part of the magazine—which, as we have somewhat sadly observed before, doesn't sound like much of a compliment to the editors.

—*Henry D. Ralph.*

close at hand...

Yes, as close as your telephone or the Hinderliter sales engineers in your area.

Chances are that the type of Hinderliter Tree generally used in your field has already been designed. While your particular wells or your practices may require variations, Hinderliter Trees can be delivered when you need them.

Hinderliter Trees are fabricated to your individual specifications and every component has been field tested for performance. You can reduce completion time and cost, and be assured of safety for well and equipment with Hinderliter *"Better Built"* Trees.

HINDERLITER PORTER "Better Built" EQUIPMENT

Sold only through SUPPLY STORES

HINDERLITER TOOL COMPANY DIVISION

H. K. PORTER COMPANY, INC.

TULSA 1, OKLAHOMA **DRAWER 2650**

NEXT WEEK

• **ANNUAL NATURAL-GAS NUMBER.** — This issue will feature a special United-Texas Eastern Gas Pipe Line section. These two systems represent the nation's major activity in this field. Details of economics, design, and construction are included.

- New Petrochemicals Plant in Canada
- How to Avoid Unsuccessful Water Floods
- New Oil-Base Drilling Mud
- Other articles and regular features.

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THE OIL AND GAS JOURNAL

Vol. 50, No. 52

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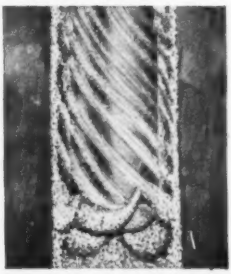


The "whirling" motion given to the cement slurry as it is discharged from a Baker Wash-Down Whirler Shoe causes the cement to encase the centered shoe joint with a more uniform body of cement, and reduces to a minimum the hazard of channeling.

This labor mess needn't have happened

THE entire steel industry and perhaps a third of the oil industry is shut down as this is written—shut down by strikes which needn't have happened.

These strikes are entirely the result of government interference—government control imposed in the name of national defense and public welfare but employed for political ends.

The human and eternal desire of workers for more pay was fanned into extreme and adamant demands through the administration's incessant talk about inflation and high prices, a campaign designed to arouse public fear to the point of voting continued controls.

Having scared wage earners into seeking big pay increases, the administration then took over the negotiations for agreements, effectively setting aside normal operations of collective bargaining. At the same time it broke its own rules for wage stabilization while refusing price increases to compensate for the higher labor costs it fostered. The whole weight of the federal Government was thrown onto one side of what should have been a bargaining process.

Under such conditions it was not unnatural for other unions to take advantage of this favorable situation.

THE petroleum industry has been singularly free from strikes and serious labor disturbances. There is every reason to believe that the present request of oil workers for more pay could have been worked out peacefully if the Government had not set the pattern of interference and partiality.

Now a large part of the nation's vital industry is immobilized by strikes. The immediate problem is to get out of this mess before the whole country is paralyzed.

The acuteness of the strike situation can be laid directly to the fact that the administration, in its ostensible effort to curb inflation, has acted as a partisan instead of an umpire. Things couldn't have been worse if the Government had never undertaken any pretense of "economic stabilization."

THE best course now would seem to be for Congress to chop off at the roots all wage and price controls, all federal meddling in economic processes and industrial relationships, all presidential emergency powers.

Then management and unions, buyers and sellers, could work out their relationships and their balances in the play of the bargaining table and the market place. In the oil industry, at least, this has always brought better results than the mess we're in now.

THIS WEEK

EVIDENCE OF CALIFORNIA'S CLAIM that the state is far from through as a source of new petroleum reserves is this well of Richfield Oil Corp., a new field discovery. This deep test on the flank of Wheeler Ridge field had a static bottom-hole pressure of 5,420 psi., a low gas-oil ratio, and high permeability and porosity factors. Initial gage was at a rate of 1,170 bbl. daily from 151 ft. of a sand formation of unknown thickness at the bottom of the well, which was drilled to 9,757 ft. The sand is believed to be of Eocene age.

INTERNATIONAL—Standard-Vacuum begins construction on 15,600-bbl. refinery at Durban, South Africa. . . . Initial operation expected in late 1953 or early 1954. . . . ¶Bidders on new concessions in Venezuela giving up idea government will act soon. . . . Election on constitutional government scheduled later this year suggests governing junta may want to wait and let possible new government pass on important decision. . . . ¶I.P.C. line from Kirkuk field to Banias finished. . . . Completion of pump stations will permit movement of 300,000 bbl. daily. . . . ¶Brazilian chamber rejects administration bill setting up government oil monopoly. . . . Grounds for rejection, however, were that it still would permit foreign companies to participate. . . .

DRILLING—Phillips stakes four 15,000-ft. wells around its deep, tight wildcat, the 1 Glenna, in Pecos County, Texas. . . . ¶Rocky Mountain sets record with staking of 70 new locations in 1 week. . . . ¶Canadian Gulf says it may suspend huge development program in Pincher Creek gas field in view of provincial decision that exports may be made only from Peace River. . . . ¶Union Oil Co.'s deep Torrey Canyon wildcat in Santa Clara Valley finds oil below 9,000 ft. . . . Second deep test planned. . . . ¶Amerada official in report on Williston basin drilling says deep wildcats cost more than $500,000, Madison wells in Beaver Lodge area require $210,000. . . .

REFINING—Malco Refineries buying 1,500-bbl. refinery of Petroleum Products at Prewitt, N. M. . . . Malco president says new cat poly, cat reforming, and thermal cracking facilities to be installed. . . . ¶Work begun on Sun refinery at Sarnia. . . . ¶Canadian survey indicates 27,000 bbl. of new capacity will be added during 1952, bringing nation's total capacity to more than 180,000 bbl. daily. . . .

PRICES—Well-head gas prices are too low, but state or federal price fixing isn't the answer, Ernest Thompson says. . . . Hike of 5 cents per M.c.f. would cost the consumer only 25 cents a month, he tells Southern Gas Association. . . . ¶Federal control of oil prices attacked at I.P.A.A. meeting by Charlton Lyons, president, who declares there is no threat of a shortage or of an unreasonable increase in crude price. . . . ¶Industry leaders tell gas men the 6 per cent limit on gas-company returns on investment will hamper plans for needed expansion.

STRIKE—Oil strike shuts down third of nation's refining capacity almost overnight. . . . Washington officials reluctant to take immediate action, hoping for successful local negotiations over nation. . . . Immediate settlement of dispute at Indiana Standard's Sugar Creek refinery on 15-cent basis as possible pattern for industry. . . .

ACTIVITY—Production of crude and lease condensate averaged 6,374,275 bbl. daily for week ended April 26, up 9,750 bbl. daily. . . . ¶Total well completions for the week amounted to 844, down 86 from previous week but up 67 from same week last year. . . . Wildcat completions increased 12 wells to 199. . . . ¶Rotary rigs operating in United States decreased for the third consecutive week to 2,714 on April 28. . . .

TRENDS—Original reductions in crude allowables for May will cut production of crude and lease condensate to about 6,200,000 bbl. daily. . . . Crude imports have been averaging about 500,000 bbl. daily. . . . Crude exports and losses account for 120,000 bbl. daily, leaving 6,580,000 bbl. daily for refinery runs. . . . Runs averaged 6,490,000 bbl. daily for 4 weeks ended April 26. . . . Since crude stocks are high, further cuts in crude production must approximate reductions in runs caused by strikes.

Strike Hits Industry

Indiana Standard makes quick 15-cent settlement at Sugar Creek; Washington hopeful for early return to operation

STRIKES called by the Oil Workers International Union (C.I.O.) at midnight April 29-30 had closed down about one-third of the nation's refining capacity by Thursday and threatened to stop many other operations in the petroleum industry.

But negotiations for settlements were going on at the local level at most of the struck plants and there were indications that a pattern for new wage contracts was emerging.

In Washington, government officials at the week end were hopeful that all labor disputes in the oil industry would be ironed out before cessation of operations assumed serious proportions.

They were heartened by the quick settlement by Standard Oil Co. (Ind.) with the Central States Petroleum Union at the company's refinery at Sugar Creek, Mo., within 24 hours after the strike began.

That settlement provided for an increase of 15 cents an hour effective May 1, a 4.2 per cent cost of living raise on the old pay rate, retroactive to last November 16, and a differential of 4 to 6 cents on the second shift and 6 to 12 cents on the third shift.

Announcing receipt of a report on this settlement, Cyrus Ching, director of the Federal Mediation and Conciliation Service, expressed hope it would serve as a pattern for the whole industry. Government agencies were taking no part in the strike negotiations other than to offer their good services in bringing the parties together.

Union's terms.—The original demands of the O.W.I.U. were for an increase of 25 cents an hour plus shift differentials and fringe benefits. Regulations of the Wage Stabilization Board prohibited the companies from paying more than 10 cents an hour. All agreements for greater increases must be approved by the WSB.

It was known that several other companies were offering increases of approximately 15 cents per hour with commensurate increases in shift differentials, but in most places the unions were talking in terms of about 18 cents an hour. While the O.W.I.U. spearheaded the strike movement, it was joined by a number of other unions not affiliated with the C.I.O.

Except for Sinclair Oil Corp. and subsidiaries, which has a nation-wide contract with O.W.I.U., all negotiations were being conducted on a plant-by-plant basis, so that final terms of settlement might vary somewhat by localities. Throughout the negotiations all other oil companies have insisted they would not bargain on a company-wide basis.

Outlook by areas.—A survey Thursday indicated that there were no work stoppages on the West Coast, and on the East Coast only two or three refineries were closed.

All refineries in Louisiana were operating but in Texas a majority of the refineries were struck. Throughout the Mid-Continent, Rocky Mountain, and Great Lakes areas, the situation was spotty, with refineries operating in some areas and not in others.

There were indications that the shutdown would spread to other branches of the oil industry, even though not formally struck, because of sympathetic walkouts and the refusal of other workers to cross picket lines thrown up around refinery terminals and other installations.

Crude oil immediately started backing up in pipe lines as refinery tankage was filled, and pipe-line operators gave notice that they must curtail the taking of crude from the fields as soon as their own tankage was filled.

The Oklahoma Corporation Commission issued an emergency order Thursday permitting crude-oil buyers to prorate their purchases in accordance with their ability to move crude out of the producing fields. Regulatory bodies in other states were considering similar emergency measures for an orderly curtailment of production in fields where pipe-line outlets were blocked.

A number of gas-transmission companies issued warnings that they might have to curtail deliveries of gas because of the strike. In some cases workers at compressor stations were walking out, and other curtailments were expected because of the partial shutdown of many oil fields which also produce gas for the pipe lines.

Stocks of petroleum products are currently at a high level, and probably would serve the nation's needs for some little time, but local shortages were predicted within a few days because of the difficulties of distributing stocks from refinery and bulk terminals to service stations and customers. Most railroads and many large industrial users announced that they had sufficient stocks of petroleum products to operate for several weeks.

Strike Policy

Government to keep hands off pending developments

WASHINGTON. — Indications here at the end of the week were that the Government would wait at least several days before attempting any further intervention in the oil and steel strikes beyond the efforts of conciliators to bring companies and unions together.

The steel industry was technically under government control while the Government is carrying to the Supreme Court an appeal from the decision of District Judge David A. Pine issuing an injunction against the seizure action. However, the strike of steel workers called immediately after Judge Pine's decision was still in progress.

The National Production Authority reinstated its embargo on shipments of steel products which it had put into effect some time back when a steel strike was narrowly averted by government seizure of the plants *(The Oil and Gas Journal, April 14, page 101)*.

The first government action resulting from the oil strike was aimed at protecting petroleum supplies along the industrially vital eastern seaboard.

Contents of order.—In an order designed to protect the normal flow of oil products, the Petroleum Administration for Defense prohibited deliveries of motor gasoline, kerosine, distillates, diesel oil, and residuals to resellers or large volume consumers in the 17 eastern states and District of Columbia if they have more than 10 days' inventory of those products.

PAD order No. 5, effective May 1, also provides that no deliveries may be made to gas, water, or electric utilities in the specified area who have more than 15 days' supply on hand.

The order further prohibits export to foreign countries other than Canada without PAD approval, but this prohibition will not apply to exports from California, Oregon or Washington.

The order does not cover aviation gasoline, of which the military reportedly have substantial stocks, and restrictions on that product will be handled separately. The Army, Navy, Air Force, Coast Guard, and Atomic Energy Commission also are

exempted from the inventory limitation.

Also exempted from the restriction are deliveries to homes and to tanks forming an integral part of mobile equipment such as automobiles and tractors.

To provide for maintenance of normal operations as far as possible, resellers with their own manufacturing facilities or tankers, barges or pipe lines, holding less than the specified maximum inventories, may accept deliveries in their customary quantities.

The Wage Stabilization Board also met to canvass the oil situation but was told by the Federal Mediation Service that as of the moment strikes had not affected a substantial portion of the industry so as to warrant emergency action.

New Imports Feared

With the hemisphere's producing capacity building up, I.P.A.A. foresees trouble unless output is controlled

Bertram F. Linz

COLUMBUS.—Independent producers opened fire last week on oil expansion programs in which they saw dangers of a new flood of imports within a few years.

The import outlook and price control were the major subjects of discussion at the midyear meeting of the Independent Petroleum Association of American where the groundwork was laid for adoption of a strong import policy by the membership at the annual meeting next October.

Preliminary reports of subcommittees on Western Hemisphere oil warned of the possibility of excess capacity of as much as 2,500,000 bbl. daily in the United States by 1955 if expansion continues after 1953 at the pace established by the current program of the Petroleum Administration for Defense.

The directors adopted a statement endorsing the expanded drilling program for the domestic industry but pointing out that if this program is to be attained and reserve capacity necessary to assure national defense, developed "domestic markets must be maintained for domestic crude."

Domestic production is now being curtailed and the development of foreign production is a threat of further curtailments, the statement said, and therefore "the directors of the Independent Petroleum Association of America now call for a reduction in the importation of crude oil and products commensurate with reductions in domestic production, and demand that an equitable proportion of reserve productive capacity be carried by the various producing areas."

Foreign expansion. — While domestic producers at present are not greatly embarrassed by imports because of the rapid increase in demand and the shutdown in Iran "there is currently a trend, unless changed, that will again bring to the front the question of the importation of oil and what to do about it," Russell B. Brown, general counsel, said in a report to the meeting. The problem may assume major importance more quickly if Iran comes back into production, he indicated.

Bringing the problem before the general session for discussion, Charlton H. Lyons, president of the association and chairman of the Western Hemisphere oil study committee, charged the administration in Washington has adopted a policy that international interests transcend national interests. This policy sees America as the world leader and results in powerful pressures to spend money and materials abroad, a trend which if continued may lead to major consequences, he said.

Excess capacity. — Projections of the subcommittee on production and reserves based on the PAD expansion program indicate that by 1955 there will be excess capacity of 1,800,000 bbl. daily in the Western Hemisphere and 3,000,000 bbl. by 1960, A. I. Levorsen of Tulsa reported. He placed the 1955 production at 11,000,000 bbl. and productive capacity at 12,800,000, and for 1960 saw production at 13,000,000 bbl. daily and capacity at 16,000,000 bbl.

Levorsen emphasized the wildcatter must be protected "if resources are to be translated into reserves" and said there is no lack of places where discovery will be successful, pointing out that advances in technology continually open up sources of oil not previously recognized.

In addition, he said, there is a "challenge to the industry" in the 130,000,000,000 to 150,000,000,000 bbl. of oil now considered nonrecoverable in pools from which only 40 per cent has been recovered by known methods.

Recovery of this oil could be developed in an emergency, Levorsen said, and the shale of the United States and Brazil and the tar sands of the United States and Canada also must be considered as "safety factors" over the next 25 years. The domestic industry can supply the needs of the nation over a long time to come, he insisted.

Cutbacks predicted.—On the basis of past experience, Western Hemisphere demand will be 10,227,000 bbl. daily by 1955, it was estimated by J. P. Coleman of Wichita Falls, Tex., chairman of the supply and demand committee.

Projecting development from the PAD program, Coleman said there could be excess productive capacity of 2,500,000 bbl. daily in the United States alone by that time.

Coleman explained that total domestic demand in 1955 is indicated at 8,682,000 bbl. daily plus 182,000 bbl. of exports against productive capacity of 9,600,000 bbl. daily. If drilling is done in Latin America at projected rates, that area might have an exportable surplus of 1,800,000 bbl. daily of which 1,320,000 bbl. would be seeking a market in this country.

Coleman said, however, he does not believe that will happen because it is obvious that under the present price system producers will not build up a great reserve in this country "because we don't have the means to do it."

"Something is going to have to give," he said. "Either South America is going to have to be cut back some or the domestic program must."

Coleman calculated that whatever excess capacity is developed would be concentrated in Texas because that state has the machinery and laws to do it," but he pointed out Texas could not carry the burden of a 2,500,000-bbl. daily surplus which would necessitate curtailment of production to 15 days a month.

Either drilling in the United States or South America must be curtailed, he said, or South America must adopt conservation and proration. The latter would be best, he pointed out, because there then would be excess capacity all over the Western Hemisphere. He questioned whether South America, now producting all it can and having a surplus of only 8,000 bbl. daily, would willingly adopt such a plan.

Steel supply.—Submitting the report of the materials subcommittee, L. Dan Jones, assistant general counsel, warned of the possibilities of a 10 to 15 per cent shortage of steel for steadily expanding development. Continuation of the present rate of increase will mean the drilling of 60,000 wells a year by 1955, he said. This would require nearly 3,000,000 tons of steel but the current supply of new pipe is less than 2,000,000 tons a year.

Jones told the meeting the PAD program is contingent upon increasing pipe production as now expected, continuance of availability of conversion steel, limited exports of pipe, and an increase in imports. The program for increased production calls for over three times as much development as occurred in 1946, he concluded.

Strippers' plight.—Frozen crude prices and steadily rising costs are making it economically impractical to expand

many secondary recovery projects to include acreage where recoverable reserves are known to be limited or marginal, the secondary recovery and stripper well committee reported.

With an anticipated further increase in the price of steel, as well as in labor and other costs, the committee warned, the position of the stripper-well operator will become even more precarious, raising possibilities of limited production and forced premature abandonments.

To illustrate the influence of costs, the committee pointed out that they have risen between 40 and 50 per cent in water-flood and stripper operations since 1947, but in that time there has been no general increase in the price of crude. Only the depletion allowance keeps many operators going, it said.

"To assure needed progress in water-flood operations and in the maintenance of our stripper production, the combined output of which constitute a vital part of our nation's daily production, serious attention should be given the cited factors and their relationship to the absolute need for decontrol of crude oil prices," the committee concluded.

Leasing changes. — Liberalization of the federal leasing act to permit lessees to hold up to 50,000 acres of publands in each state was recommended in a report of the federal and public lands committee.

The committee also called for changes in Interior Department administrative policies, one of which would require applicants for leases on small isolated tracts to show they were acting in good faith with a bona fide intent to develop the land and not speculative purposes. Another change would make default of rental payments a cause for cancellation of leases.

Oil vs. Reds

PAD's foreign program is to help the free world battle communism, not to hurt U. S. producers, Bruce Brown says

COLUMBUS.—The domestic oil industry is inextricably linked to the oil industry of the rest of the free world by reason of the need for defense against communist aggresion, it was asserted here last week by Deputy Petroleum Administrator Bruce K. Brown.

The United States should keep itself in such a position that, come what may, the country will always have sufficient developed petroleum resources within its own borders to defend itself, but the defense against communism makes it necessary to consider the oil resources of the whole free world as a unit, Brown told the midyear meeting of the Independent Petroleum Association of America.

"To save tankers and to save manpower, the armed services of the United States should be able to operate abroad to whatever extent necessary on petroleum supplies drawn from the closest possible source—not just from the United States," Brown declared.

"To the extent that we can accomplish this, a barrel of foreign oil is just as valuable in national defense as a barrel of domestic oil."

Congress itself set up this program in establishing the Economic Cooperation Administration, giving aid to Greece, Turkey, and other countries, and entering the North Atlantic Treaty organization. When the Petroleum Administration for Defense was set up, its field covered not just oil for the United States but oil for the whole free world, he explained.

Keeping pace.—Crude-oil production and the installation of refining facilities, world-wide, have kept pace with world-wide demands so far, Brown said. The rate of increase in demand has been greater in the Eastern than in the Western Hemisphere, and the rate of increase in production and refining capacity also has been greater in the Eastern than in the Western Hemisphere.

Over-all, though, supply has barely kept abreast of demand and there is too little of the flexibility that would be essential if we were forced into an all-out fight. Further increases in capacity are needed even if we do not run into the great new demands of a major war—merely to keep supply in step with demand.

"There are, I know, those who fear that such increases, if they come in foreign lands, represent a threat to the domestic industry," Brown said. "For the moment certainly, and for the foreseeable future as well, such a fear seems groundless. What increases have come abroad have come, not because there is any plot afoot to endanger the United States industry, but simply because the demand has been there and the supplies had to be found to meet it.

"Certainly we in PAD will never be a party to any move that might weaken our domestic industry. Our primary concern is and must be with the domestic industry. We know that only the oil supply available inside our country can be considered absolutely safe, that supplies from other nations necessarily run a descending scale of safety, depending on distance, sea lanes, and international political situations."

Domestic concern. — This concern of PAD for the domestic industry is evidenced by its expansion program, Brown told the association. While it is planned to drill 10,128 wells abroad during the next 6 quarters, 88 per cent of them will be in the Western Hemisphere and at the same time 80,000 wells, or eight times as many, will be drilled within the United States.

"The United States is bound by treaties and by economics to all the nations of the hemisphere, and an adequate supply of oil is just as vital to them as it is to us," Brown said.

"Like it or not, oil is global, and it seeks its level throughout the world with little regard for national boundaries or even for hemispheres."

Flexibility needed.—The Iranian shutdown last year demonstrated that the Western Hemisphere as a whole has much less flexibility in oil supply than is needed and that only a few of the Latin American countries could develop sizable increases in output speedily, the association was told by William H. Farrand, director of PAD's foreign division, who followed Brown.

PAD's experience in shuffling world supplies to meet the Iranian situation was a contributing factor to the determination to prepare its expanded petroleum program, Farrand disclosed.

"It was essential, we realized, to build free-world reserves to a point at which safety, even though not assured, would at least be within reach," he said.

Industry Briefs

WASHINGTON.—A U. S. Supreme Court decision on the constitutionality on part or all of Oklahoma's 1945 oil-unitization act may be expected before June, a court spokesman said last week. The court now has under advisement objections to operations of the Medrano pool in the Cement field of Caddo County, Oklahoma, under the law, which was passed to curb waste of oil and natural gas, and under which much of the state's soil is produced.

CHICAGO.—Pure Oil Co.'s most intensive drilling program will result in the sinking of almost one well per day this year. Raleigh Warner, chairman of the board, told the Analysts Club here that four-fifths of the company's wells will be for development while the remainder will be exploratory tests. Warner said that Pure would drill a substantial number of wildcats in the Gulf of Mexico, among other areas, if the tidelands dispute is settled reasonably soon.

TULSA.—P. C. Spencer, president of Sinclair Oil Corp., said last week that the company is planning a new office building here to house its production personnel. The production force currently is "located in a dozen buildings," he said, because the present headquarters hasn't sufficient space.

Analysis Can Improve

Human element blamed in N.G.A.A. report for most errors committed by labs in low-temperature fractional analyses

F. Lawrence Resen

HOUSTON.—Laboratories are running more accurate low-temperature fractional analyses, but there is still plenty of room for improvement.

This was brought forth at the Natural Gasoline Association of America's annual meeting by A. J. Miller, Phillips Petroleum Co., in a report on the results of the organization's fractional-analysis program.

The report compared 510 test results submitted by 77 industrial and commercial laboratories which analyzed liquid samples prepared by Phillips' special-products division. It is similar to a program instituted in 1950 when 60 laboratories submitted 300 results. The latest tests show that the laboratories have been improving their techniques since the first program, but that over-all wide deviations in results indicate that more has to be done.

Human element blamed.—It was concluded that major errors are not due to basic procedures or apparatus but are attributable to human-element factors such as improper application, lack of understanding, inadequate training, and miscalibrations. The results have stimulated interest in an analysis-training school and trial of certain promising auxiliary techniques in a group of laboratories.

The N.G.A.A. fractional-analysis program has been conducted by the fractional-analysis subcommittee of the N.G.A.A. technical committee and has surveyed the accuracy of analysis of hydrocarbon liquids by low-temperature distillation on an industry-wide basis.

The tests found that the mean deviation from the true value, averaged for all components, ranged from 0.55 to 1.04 mol per cent for the various types of samples analyzed. Greatest deviation was found to occur on separation of isomers. The application of holdup corrections was found to reduce, but not eliminate, the tendency towards low analytical values for the lowest boiling component.

Gathering systems.—C. L. Ritter, Continental Oil Co., Houston, said one of the most difficult problems in producing and gathering low-pressure gas is encountered in sizing main lines since field-development programs are usually incomplete when a plant and gathering system are planned.

Speaking before the gathering-systems forum, Ritter said that the method now being followed by Conoco calls for a thorough gas survey by the gas tester and plant personnel. This data is then correlated with information from the petroleum and reservoir-engineering groups. From the accumulated data all the factors are correlated, the oil and gas reserves and potentials are worked out, and a forecast is made as to the expected gas production for a period of years.

The pipe lines have to be able to handle the available gas volume without causing undue pressure increases at the ends of the gathering systems. Experience has shown that allowance must be made in capacity for peak gas loads. In the majority of cases it has been found satisfactory to size the main lines for 15 to 33⅓ per cent more gas than the expected average daily volume.

Carryover problem.—The problem of oil and/or salt water carryover from separators or heater treaters was brought forth as being a constant problem.

To minimize this Ritter proposed that consideration be given to peak rates of flow and expected minimum operating pressures in sizing the equipment to be installed.

Metering difficulty.—One of the biggest difficulties in metering is encountered with gas-lift gas when surges cause gas to be lost to the system. Some of Continental's difficulties were overcome in this phase by working closely with the producer.

In one instance, the volume of gas lost due to gas-lift surges was cut down by changing the intermitters from 3 or 4 long injections to 20 or 30 short injections per day. In many cases, the load on the gathering system was relieved by altering the injections of gas between two or more wells.

Officers.—The entire slate of present N.G.A.A. officers was reelected for the coming year. They are: John F. Lynch, La Gloria Corp., president; Z. C. Ambrose, Southwest Gas Producing Co., R. W. Heath, Signal Oil & Gas Co., F. M. Perry, Cities Service Oil Co., Albert H. Weil, United Gas Pipe Line Co., vice presidents; and William F. Lowe, Tulsa, secretary-treasurer.

New officers for the Natural Gasoline Supply Men's Association are: M. E. Duncan, Johns-Manville Sales Corp., Tulsa, president; M. A. Ellsworth, Fluor Corp., Ltd., Tulsa, first vice president; C. C. Clover, Westcott & Greis, Inc., Tulsa, second vice president; H. M. Anderson, Brown & Root, Inc., Houston, treasurer.

THEODORE W. LEGATSKI

Legatski Honored

1952 Hanlon Award goes to Phillips researcher

HOUSTON. — The Hanlon Award, top honor of the natural-gasoline industry and one of the highest in the petroleum industry, was presented here last week to Theodore W. Legatski, assistant director of research of Phillips Petroleum Co., Bartlesville.

Legatski became the sixteenth recipient of the award, presented annually by the Natural Gasoline Association of America and given by E. I. Hanlon, chairman of the board of the National Bank of Tulsa and a pioneer in the natural-gasoline industry. It is presented for outstanding service to the natural-gasoline and cycling industries.

In presenting the award, N.G.A.A. President John F. Lynch, of La Gloria Corp., Corpus Christi, said the association was recognizing Legatski's "25 years of productive research and guidance in the field of light hydrocarbons."

Research productive.—The results of that research, he said, have strengthened and extended the outlets of the industry's products and have made valuable contributions in the field of aviation-gasoline manufacture and to the better understanding "of the relationships between fuel composition and engine behavior."

Legatski joined Phillips in 1925 after receiving his degree in chemical engineering from the University of Michigan.

In the company's small research department he began his studies of precision methods for the anlaysis of natural gasoline and gases, which led to research on extraction, distillation, and rectification.

In 1929 he became supervisor of the company's Burbank, Okla., laboratory and soon was made assistant director of research at Bartlesville.

Legatski is best known for his contributions in the commercial application of precise fractional distillation as a means of obtaining substantially pure hydrocarbons which are used in aviation-gasoline blending, chemicals manufacture, and as research starting materials.

Process-Design Progress

Simpler approaches to complicated calculations involved in fractionation, absorption outlined at N.G.A.A. meeting

HOUSTON.—Solutions to mathematical problems in absorption, stripping, and fractionating operations were suggested by authors participating in the extraction and separation-calculations forum of the thirty-first annual meeting of the Natural Gasoline Association of America here last week.

In discussing process engineering for natural-gasoline plants, three Phillips Petroleum Co. scientists said that binary fractionation data can help solve multicomponent fractionation problems.

The authors, E. N. Pennington, F. H. Poettmann, and K. H. Hachmuth, said in their paper that acceptable and usable approximate solutions of a great number of fractionation-design problems are possible by use of a correlation of these data. Using this method, they said, it is possible to obtain a solution to a multicomponent fractionation problem with a minimum of time and effort.

Only one trial-and-error, bubble-point calculation is required and few other auxiliary calculations are needed. If average relative-volatility ratios are used for each section of the column, they said, the correlation is capable of approximating the location of the feed entry.

The method also may be used as an aid in determining the concentration of components other than the key components in the vicinity of the feed tray. As such, it is a convenient tool in making the first approximation for more rigorous methods of calculations, if desired, they added.

Water factor important.—Another Phillips study recognized water as an important consideration in the design and operation of rich-oil deethanizers.

A paper on this subject presented by B. J. Ferro, H. R. Legatski, and K. H. Hachmuth said that equilibrium constants for water in a hydrocarbon system are in the range of the constants for ethane. The effect of the water in the reboiler of a rich-oil deethanizer is to displace substantially all of the ethane from the reboiler liquid.

The excess water, if not removed, will strip not only the ethane, but also some propane and heavier hydrocarbons, they said.

Calculated boiling temperature of deethanizer bottom products that are assumed water-free will differ from actual reboiler temperatures by 100° F. or more, they agreed. However, they said, when the effect of water is taken into account, the calculated and actual temperatures are in agreement.

The separation-factor method will give consistent and conservative results compared with the more rigorous step-by-step procedure in calculations involved in fractionator design, according to a paper presented by R. O. Shelton, R. L. McIntire, and K. H. Hachmuth, all of Phillips.

The time required to obtain a workable solution is not as great and remains fairly constant regardless of the number of components or the number of equilibrium steps, they said.

The number of steps is about the same with either method, even when the true absorption and stripping-factor progressions differ widely from the assumption of a geometric progression, they said.

Papers in this Issue . . .

Eight of the technical papers presented at the annual N.G.A.A. meeting appear in this issue in the special section following the news section.

The authors and the titles of their papers are: W. F. Oxford, Jr., Sun Oil Co., "Use of Surface Active Agents in Cooling Tower Water Treatment"; John Eichelman, El Paso Natural Gas Co., "Gas Turbine Driven Compressors"; Rex Lane and B. J. Thompson, Warren Petroleum Corp., "Absorption and Dry Distillation"; R. L. Loofbourow, E. J. Longyear Co., "Aspects of Excavated Underground L.P.G. Storage"; G. H. Billue, Security Underground Storage Co., "Problems Encountered in the Installation and Operation of Underground Storage in Salt Formations"; Roy A. Schuster, Chicago Corp., "Problems in Producing and Gathering High Pressure Gas"; G. W. McCullough, Phillips Petroleum Co., "Engineering for Safety"; and Joe F. Wood, Skelly Oil Co., "The Training of Analysts."

Corrosion Solution

Problem in gas-condensate wells now under control, but method costs can be cut, Zajac tells natural-gasoline men

HOUSTON. — The gas - condensate well-corrosion problem can now be considered as under control although opportunities for improving the economics of various control measures still exist, T. S. Zajac, Shell Oil Co., New York, told members of the gas-corrosion forum during the annual meeting of the Natural Gasoline Association of America here.

A conserted cooperative effort over the past 9 years has resulted in discovery of suitable alloys for wellhead assemblies and for special installations in tubing strings. Several chemicals have been found to be satisfactory and economical for use as neutralizers and inhibitors. Also, several tubing alloys and coatings are in fairly widespread use, and their current performance indicates that they will be economic solutions to the tubing-corrosion problem.

What corrosion costs.—Zajac, as chairman of the corrosion-research project committee of N.G.A.A., gave a progress report on economics of gas-condensate well corrosion. Available data to date show that averaged actual costs of uncontrolled corrosion range from a low of 94 cents per M.M.c.f. to a high of $32.60 per M.M.c.f. The higher figure is somewhat out of line but shows the extent to which costs can rise if unchecked. The average of costs in 19 fields in Colorado, Louisiana, Mississippi, and Texas, omitting the one high figure, came to $4.72 per M.M.c.f. equated to 1951 dollar value.

Costs for chemical treating ranged from 3 cents to $1.62 per M.M.c.f. depending upon individual operating conditions encountered. Treating costs averaged 17, 18, and 53 cents per M.M.c.f. for chromates, neutralizers, and liquid organic inhibitors, respectively, the report showed.

The magnitude of the corrosion problem has been increasing in recent years to where now 45 per cent of all gas-condensate wells in the Southwest may be classified as corrosive, Zajac said. He pointed out that some 77 per cent of the nation's gas reserves are in five southwestern states of Louisiana, Mississippi, New Mexico, Oklahoma, and Texas, and the corrosion problem assumes great importance in this region. He said that Texas, alone, with reserves of 105.7 trillion cubic feet, holds 55 per cent of the nation's supply and Louisiana, with 29.0 trillion cubic feet, has 15 per cent of the total.

NEW OFFICERS of the Rocky Mountain district of the American Petroleum Institute's Division of Production following their election in Casper. Left to right are Claude Peavy, Phillips Petroleum Co., Denver, vice chairman for Colorado; C. L. Cooksey, Carter Oil Co., Vernal, vice chairman for Utah; C. H. Griffin, Phillips, Casper, retiring chairman and new head of the advisory committee; A. F. Barrett, General Petroleum Corp., Casper, new district chairman; S. J. Lintzenich, Hughes Tool Co., Casper, secretary-treasurer; and H. H. Healy, Ohio Oil Co., Casper, vice chairman at large. Not in the picture are H. B. Geznert, Trigood Oil Co., Casper, vice chairman for Wyoming; and R. D. Smith, Union Oil Co., Great Falls, vice chairman for Montana.

How Williston Is Drilled

Costs, casing program, formation data, and other factors outlined by Danchertson before Rocky Mountain meeting

CASPER, Wyo.—What is involved in drilling a well in the Williston basin was outlined here before the annual meeting of the Rocky Mountain Oil and Gas Association by Charles H. Danchertson, Amerada Petroleum Corp., Tulsa.

Present cost of drilling a nonoffset well to the Madison (about 8,500 ft.) in the Beaver Lodge area, Danchertson said, is about $175,000 for intangibles and $35,000 for equipment. Deep wildcats, he declared, cost more than $500,000.

Amerada's year-old wildcat which discovered oil in the basin cost the company $656,000 in intangibles and $65,000 in equipment expense, he said. The costs included tests of both the Devonian and Madison.

Drilling practices.—In drilling in the Beaver Lodge area, Danchertson said, conventional mud is used down to 7,500 ft. At this depth a switch is made to salt-base mud. Logging problems are solved by use of gamma ray for lithologic determinations and use of Laterolog and MicroLog for picking formation tops and productive zones. A neutron curve is run for the entire hole.

Casing program adopted calls for 10¾-in. surface pipe set below 600 ft., with 5½ or 7-in. set through the Madison for a producing string in that reservoir. In deeper Devonian wells an intermediate string of 7⅝-in. or 9⅝-in. pipe is set to 3,500 or deeper, with 5½-in. set as the oil string.

For winter operations, the ground was covered with straw and coal and burned off to thaw the ground enough to permit digging of pits. Steam and water lines were laid side by side in a common ditch.

Rig fuel now used is butane, but use of gas is expected with further development. Boilers use either crude oil or gas, and on some isolated locations lignite is burned.

Danchertson said that drilling of the discovery well consumed 329 days of rig time, with only 142 spent in actual drilling. It was completed in the Devonian and later plugged back for recompletion in the Madison. The speaker said first cores were taken below 10,000 ft., accounting for failure to make a Madison discovery during drilling.

Field data.—Field rules in Beaver Lodge include a 200-bbl. daily pro-

CITATIONS FOR SERVICE to the Rocky Mountain district of the A.P.I.'s Division of Production were awarded these men at the annual meeting in Casper. Left to right are Z. K. Brinkerhoff, Jr., Brinkerhoff Drilling Co., Casper; H. A. True, True & Brown, Casper, accepting the citation on behalf of Hugh A. Stewart, now with the Petroleum Administration for Defense in Washington; J. F. Cullen, Stanolind Oil & Gas Co., Casper; J. C. Donnell, II, Ohio Oil Co. president and A.P.I. vice president for production, making the presentations; and Tom Dougherty, Petroleum Information, Casper, accepting the award on behalf of Irving Garbutt, former oil editor of the Casper Tribune-Herald, Casper.

duction allocation to each well. Spacing is on a 40-acre pattern, and semi-annual bottom-hole surveys are required. Permissible gas-oil ratio is 2,000 to 1.

Danchertson said the Beaver Lodge Madison reservoir produces a light-orange colored oil of about 45° gravity having a pour point below 0° F. Pinpoint porosity, vugular porosity, and some vertical fractures characterize the formation, he said, but all three forms do not occur together.

Porosity ranges from 5 to 15 per cent and permeability from 1 to more than 100 md.

Madison gas-oil ratios range between 1,100 and 1,300, with bottom-hole pressure about 3,640 psi. Data gathered to date, he said, indicates a water drive, with good recovery expected from the reservoir.

Drilling Surge

Record 70 new locations staked; wildcatting heavy

DENVER.—The latest in a string of new records for drilling activity in the Rocky Mountains was established last week when 70 new locations were announced for the area.

Locations for new exploratory tests led the parade in every area except Wyoming, where more development wells will be drilled to increase further the production for outlet when more pipe-line transportation becomes available this summer.

The Denver basin leads in wildcat activity with a total of 8 new wildcats out of 13 new locations announced. The majority of the new locations are in Logan County, Colorado, with other wildcats in Morrill and Chase counties, Nebraska, and Weld and Washington counties, Colorado.

The importance of gas production in the western states accounted for 23 new locations in the San Juan basin of New Mexico. Stanolind Oil & Gas Co. announced location for an important wildcat in Rio Arriba County, New Mexico, along the east flank of the basin.

New locations totaled 13 in Montana and North Dakota. The Montana portion of the Williston basin has five new wildcat sites, while North Dakota has five new extension locations for the Beaver Lodge and Croff fields. The General Richey, Cedar Creek, and Pine areas of Montana each have new locations.

In Utah operations are continuing throughout the Uinta basin with two extensions at Roosevelt near completion, and testing under way at the second Duchesne well of Carter and Continental Oil Co. Drilling is climbing in Idaho, Arizona, and Nevada with more new wildcats forecast.

Oil Lines Get Pipe

Third-quarter allocations to 23 large crude and products projects total 227,285 tons; small lines get 44,465 tons

WASHINGTON.—Twenty-three large crude and products pipe lines have been granted priorities for the procurement of 227,285 tons of line pipe in the third quarter. An additional 44,465 tons will go to a large number of small projects.

The estimated construction costs of the 23 major lines was placed by the Petroleum Administration for Defense at $193,424,000, of which $116,697,000 will be for 12 crude lines, for which 101,018 tons of pipe has been allocated, and $76,727,000 for 11 products lines given 126,267 tons.

All of the large crude lines are scheduled for completion this year, three of them in the third quarter. One of the products lines is to be completed in the third quarter, seven in the following quarter, and the remaining three in the first quarter of 1953.

With the exception of the Sinclair Pipe Line Co. Drumright-Chicago project and the Rancho line, all of the crude lines are receiving their first allocations. Three of the products lines have been given previous allotments: Shell's Wood River-Chicago line; Indiana Standard's Sugar Creek-Dubuque line, and Susquehanna Pipe Line Co.'s project from Fostoria to Randolph, Ohio.

Details of the individual projects are as follows:

Crude-oil lines . . .

Sinclair Pipe Line Co.: 24-22-in. from Drumright, Okla., to Salisbury, Mo., and Chicago, 683 miles; initial capacity, 280,000 bbl. daily; estimated cost, $51,942,000; completion date, third quarter; total requirement, 144,055 tons; allotment, 10,000 tons.

Cities Service Pipe Line Co.: 18-in. from Sour Lake, Tex., to Lake Charles, La., 264 miles; initial capacity, 750,000 bbl. daily; estimated cost, $3,100,000; completion date, fourth quarter; total requirement, 8,625 tons; allotment, 8,616 tons.

Shell Pipe Line Corp., "Rancho": 24-in. from McCamey to Houston, Tex., 463 miles; initial capacity, 209,000 bbl. daily; estimated cost, $41,631,000; completion date, fourth quarter; total requirement, 129,458 tons; allotment, 51,898 tons.

Texas Empire Pipe Line Co.: 18-in. from Wilmington to Lockport, Ill., 29 miles; capacity increase to area served, 69,000 bbl. daily; estimated cost, $1,546,000; completion date, fourth quarter; total requirements, 729 tons; allotment, 4,729 tons.

Service Pipe Line Co.: 8-in. from Wink to El Paso, Tex., 200 miles; initial capacity, 11,500 bbl. daily; estimated cost, $3,283,000; completion date, fourth quarter; total requirement, 11,968 tons; allotment, 6,962 tons.

Magnolia Pipe Line Co.: 8-in., 29.5 miles in Midland County, Texas: Capacity increase, 12,000 bbl. daily; estimated cost, $575,000; completion date, fourth quarter; total requirement, 1,925 tons; allotment, 945 tons.

Interstate Oil Pipe Line Co.: 16-in. between Bunkie and Flora, La., for system revision, 35.76 miles; capacity, 107,000 bbl. daily; estimated cost, $2,935,000; completion date, fourth quarter; total requirements, 5,142 tons; allotment, 2,092 tons.

Service Pipe Line Co.: 62 miles 10, 8, 6, and 4-in. lines connecting new areas in Lea County, N. M.; capacity, 45,000 bbl. daily; estimated cost, $1,027,000; completion date, third quarter; total requirement, 3,912 tons; allotment, 552 tons.

Cooperative Refinery Association: 6-in. from Holdrege, Neb., to Phillipsburg, Kans., 48 miles; initial capacity, 5,000 bbl. daily; estimated cost, $762,000; completion date, fourth quarter; total requirement, 2,006 tons; allotment, 2,006 tons.

Gulf Refining Co. (Mesa System): 24-in. from Midland to Colorado City junction with West Texas Gulf line, 80 miles; initial capacity, 260,000 bbl. daily; estimated cost, $5,582,000; completion date, fourth quarter; total requirement, 17,305 tons; allotment, 526 tons.

Toronto Pipe Line Co. (Sterling System): 53 miles of 4, 6, 8, and 10-in. gathering lines from Logan County, Colorado, to Gurley, Neb.; initial capacity, 24,000 bbl. daily; estimated cost, $2,334,000; completion date, third quarter; total requirement, 9,692 tons; allotment, 8,392 tons.

Products lines . . .

Shell Oil Co.: 14-in. from Wood River to Chicago and Argo, Ill., 285 miles; initial capacity, 85,000 bbl. daily; estimated cost, $10,588,000; completion date, fourth quarter; total requirement, 36,917 tons; allotment, 6,238 tons.

Tuscarora Oil Co., Ltd.: 12-in. between Allentown and Tuckerton Station, Pa., 27 miles; part of an $8,398,000 rebuilding project between Allentown and Midland, Pa., which will give a 20,000-bbl. daily capacity in-

crease; total requirement, 3,059 tons; allotment, 3,059 tons.

Phillips Petroleum Co.: 54.24 miles of 6-in. loops to Mextex line between Goldsmith and Borger, Tex., and 50 miles of 8-in. line from Spraberry plant to Goldsmith; capacity increase, 8,000 bbl. daily; estimated cost, $2,729,000; completion date, fourth quarter; total requirement, 6,383 tons; allotment, 1,452 tons.

Bell Oil & Gas Corp.: 145 miles of 8 and 6-in. line from Ardmore to Drumright, Okla.; initial capacity, 9,000 bbl. daily; estimated cost, $3,270,000; completion date, first quarter 1953; total requirement, 9,012 tons; allotment, 3,956 tons.

Standard Oil Co. (Ind.): 316 miles 12-in. from Sugar Creek refinery to Dubuque, Iowa; initial capacity, 40,000 bbl. daily; estimated cost, $10,430,000; completion date, fourth quarter; total requirement, 33,180 tons; allotment, 27,180 tons.

Susquehanna Pipe Line Co.: 120 miles 8-in. from Fostoria to Randolph, Ohio, and 3½ miles 8-in. near Toledo; initial capacity, 19,200 bbl. daily; estimated cost, $3,095,000; completion date, fourth quarter; total requirement, 9,606 tons; allotment, 7,695 tons.

Phillips Pipe Line Co.: 35 miles 6-in. from Okmulgee to Tulsa, Okla.; initial capacity, 12,000 bbl. daily; estimated cost, $566,000; completion date, fourth quarter; total requirement, 1,808 tons; allotment, 1,808 tons.

Pioneer Pipe Line Co.: 310 miles 6 and 8-in. from Sinclair, Wyo., to Salt Lake City; initial capacity, 12,000 bbl. daily; estimated cost, $7,840,000; completion date, fourth quarter; total requirement, 21,639 tons; allotment, 21,639 tons.

Salt Lake Pipe Line Co.: 329 miles 8-in. loops between Salt Lake City and Boise, Idaho; capacity increase, 17,000 bbl. daily; estimated cost, $8,000,000; completion date, fourth quarter, total requirement, 19,790 tons; allotment, 9,905 tons.

Texas Pipe Line Co.: 198 miles 16-in. from Port Arthur, Tex., to Baton Rouge via Lake Charles, La.; initial capacity, 96,000 bbl. daily; estimated cost, $21,900,000; completion date, first quarter, 1953; total requirement, 28,451 tons; allotment, 28,451 tons.

Sinclair Pipe Line Co. (Harbor Products System): 89 miles 16-in. from Philadelphia area to New York Harbor area plus 4, 8, 12, and 14-in. feeder lines; initial capacity, 110,000 bbl. daily; estimated cost, $8,911,000; completion date, first quarter, 1953; total requirement, 14,884 tons; allotment, 14,884 tons.

Exports Up Slightly

WASHINGTON.—Exports of major petroleum products averaged 168,000 bbl. daily for week ended April 4 compared with 164,100 bbl. daily for week ended March 28 and an average of 162,800 bbl. daily for the 4-week period ended April 4, according to data released by the Petroleum Administration for Defense.

Shipments of motor gasoline increased to 25,700 bbl. daily from the abnormally low level of 1,100 bbl. daily during the previous week. Kerosine shipments reached the lowest point in 5 weeks. Distillate and residual fuels moved at about the 4-week average for each fuel.

Average daily exports in thousands of barrels are shown in the accompanying table for the week of April 4, the preceding week, and for the 4-week period ended April 4.

	Week ended—		Av.
	April 4	Mar. 28	4 weeks
Aviation gasoline	37.5	30.2	29.3
Motor gasoline	25.7	1.1	10.3
Kerosine	0.1	44.0	17.8
Distillate	46.2	53.5	46.8
Residual	58.5	35.3	58.6
Total	168.0	164.1	162.8

Washington Briefs

The Petroleum Administration for Defense has called meetings of the military fuels general advisory committee and the military fuels technical advisory committee, to be held in San Francisco during the course of the meeting there of the refining division of the American Petroleum Institute May 12-15. The west coast city was selected because the members of the two committees will be there for the A.P.I. sessions, as well as a number of PAD officials.

Petroleum Administration for Defense officials have not yet decided whether they will volunteer recommendations to the Office of Price Stabilization relative to an increase in crude prices. PAD is now studying information submitted by Union Oil Co. of California, the Pennsylvania Grade Crude Oil Association, and the Independent Petroleum Association of America, all of which have requests with the OPS for higher ceilings.

A raise of $3 per ton in steel prices, now under consideration in the Economic Stabilization Agency, might cost the oil industry as much as $10,000,000 a quarter. This estimate is based upon the fact that approximately 2,000,000 tons of steel a quarter is being allotted the industry, plus the cost which would be added to B products ordinarily representing some 40 per cent of the cost of new construction. The entire additional cost probably would not be felt immediately, since considerable time elapses between the sale of the raw steel at the mill and the completion of manufacture of equipment.

Michael C. Brunner has been named assistant director of the production division of the Petroleum Administration for Defense. Brunner succeeds Don R. Teis, who has left PAD to join Lawton Oil Corp. in Magnolia, Ark. Brunner was production manager of the Midland area for Shell Oil Co. before joining PAD's production division in February.

Willam S. Tarver, associate general counsel of the Petroleum Administration for Defense, has resigned to join Southern Natural Gas Co., Birmingham.

SOUTHWEST

Promising Wildcat

Phillips stakes four deep locations near tight hole

MIDLAND.—Four 15,000-ft. drilling locations have been staked by Phillips Petroleum Co. near its No. 1 Glenna, a tight wildcat in southeast Pecos County of West Texas.

The four new wells will be drilled north, west, and northwest of the Glenna well, the greatest distance being 2 miles.

There is little information available on the No. 1 Glenna, an extremely tight operation since beginning. A company rig is doing the drilling. It has been unofficially reported that the top of the Ellenburger has been penetrated at a depth of 13,775 ft. from a surface elevation of 3,369 ft.

It has been further reported unofficially that a drill-stem test taken at a depth of 13,800 to 13,927 ft. recovered gas at a rate of 4,000,000 cu. ft. per day. The tool was open 1 hour and 10 minutes using a 5,400-ft. water blanket. Water blanket was said to have started flowing in 32 minutes and gas in 40 minutes.

Area geology.—The Glenna well and the new wells are located in an area that is relatively unexplored at depth. The location would put the wells in the Sheffield Channel, a geologic feature that represents a seaway or connection between the Midland and Delaware basins during Permian and pre-Permian geologic time.

Observers agree that sediments in the channel should correspond to those found in the basin areas, in age at least. Lithology of the various formations, however, may differ to some degree although they probably will be recognizable through similarities with comparable formations in the basin areas.

Each of these new wells will cost an estimated one-half to three-quarters of a million dollars to drill, depending on how much of the completion cost is figured into drilling. The Glenna well has been under way for 14½ months now using a big company rig that if contracted for would cost in the neighborhood of $1,500 per day. It has also been reported that 7,000 bbl. of tankage has been erected in the vicinity of the 1 Glenna.

Refinery Surge

Leduc strike touched off plant-expansion drive which will push West's capacity to more than 180,000 bbl. this year

EDMONTON, Alta.—Oil refinery capacity in Canada's four western provinces reached an estimated capacity of 154,000 bbl. daily in 1951 and another 27,000 bbl. daily is expected to be added in 1952.

Refinery expansion in western Canada has followed rapidly in the wake of the 1947 oil discovery at Leduc, which set off the Alberta oil boom. It is the most direct manifestation of the industrialization that has come to the area as a result of the oil finds.

Prior to the Leduc discovery, the prairie region of Canada depended on imported crude, from the United States chiefly, for the major share of its requirements. Small refineries were located in a few western cities with capacities ranging from 300 to 10,000 bbl.

Now nearly all the crude is produced in western Canada, chiefly from Alberta, and refinery capacity has increased accordingly. There also has been a steady increase in catalytic cracking facilities to provide higher grades of petroleum products.

Meeting demand.—An Edmonton oil-refinery manager says that refinery production in western Canada now is capable of meeting all the demands of consumers with the exception of those for lubricants and for certain specialty products.

Refinery capacity at the end of 1951 in the four western provinces was: Alberta, 64,150 bbl. daily; Saskatchewan, 41,500 bbl.; Manitoba, 20,750 bbl.; and British Columbia, 28,350 bbl. daily.

Current expansion. — Construction of the proposed Trans - Mountain Pipe Line Co. line from Edmonton to Vancouver, to start this year, has led to an announcement by Imperial Oil, Ltd., that it is launching a $13,500,000 construction program at its Ioco refinery, near Vancouver. This program will raise refinery capacity there from the present 12,000 bbl. daily to 22,500 bbl. The program includes a fluid catalytic cracking unit with a capacity of 7,600 bbl. daily. Other equipment to be erected includes atmospheric and vacuum-distillation plants, a gas-recovery unit, and a treating plant.

In Edmonton, Imperial Oil now is completing a $5,300,000 program that will see the company's refinery capacity increased from 20,700 to 25,000 bbl. daily. In 1951 British American Oil Co., Ltd., and McColl-Frontenac Oil Co. opened modern refineries in Edmonton with capacities of 5,750 and 5,500 bbl. per day, respectively.

In Saskatchewan, Imperial Oil's plant at Regina is undergoing a modernization program costing $7,000,000 that is expected to raise capacity from 20,000 to 22,500 bbl. daily. One of the biggest boosts in capacity for 1952 is the additional throughput planned for British American's Moose Jaw refinery, which will bring capacity to 15,000 from 6,000 bbl. daily. Included is 4,400 bbl. daily of fluid catalytic cracking capacity.

In Manitoba, Imperial's Winnipeg refinery, costing $12,000,000, was completed last year, with a capacity of 12,000 bbl. daily.

Heavy-crude processing.—Most of the refineries handle light and medium crudes primarily, but the Excelsior and Husky Oil & Refining, Ltd., plants at Lloydminster, an Alberta-Saskatchewan border town, have lent impetus to efforts to increase production in this heavy-crude region.

Husky processed 1,411,085 bbl. of oil in 1951, an increase of 16.3 per cent over the previous year.

In the past year, Excelsior increased capacity from 2,000 to 2,500 bbl. Excelsior refines about 20 per cent of its heavy crude into light products, such as gasoline, burner fuels, and diesel fuels, 40 per cent into finished asphalt products, and the remaining 40 per cent into bunker fuel for railroads.

Work on Sun Refinery Begun

SARNIA, Ont.—Clearing and grading has begun on the site of the proposed $10,000,000 Sun Oil Co. refinery here.

Work on the refinery proper will begin as soon as service buildings are erected, according to Dr. Gordon R. Henderson, vice president and general manager of Catalytic Construction Co. of Canada, Ltd.

The refinery will have a capacity of 10,000 bbl. per day and will process crude delivered through a pipe line from Toledo completed in 1950. The site is about 1,000 ft. east of River St. Clair near the former Alloy Steel Co.

Deepest Saskatchewan Find

REGINA.—A natural gas discovery has been made in the Battle Creek area of southwest Saskatchewan to chalk up the third new gas discovery for 1952 in the province.

The new discovery was made by the team of Albercan Oil Corp., Imperial Oil, Ltd., and Calvin Consolidated Oil & Gas Co., Ltd., at 4-31-3-26 Battle Creek, 17 miles north of the United States border and 95 miles south of the previous southernmost petroleum strike in Saskatchewan—the medium oil find at Fosterton.

The gas discovery was made in the Jurassic, flowing 6,500 M.c.f. of gas daily during initial drill-stem tests. The gas was found at a depth of more than 4,000 ft. in the deepest structure bearing oil or gas in apparently commercial quantities yet found in the province.

Gas Action Hit

Gulf says it may suspend Pincher Creek development

CALGARY, Alta. — Canadian Gulf Oil Co. has hinted that it may suspend its multimillion-dollar development program in Pincher Creek gas field due to the recent Alberta legislative action approving export of gas only from the Peace River area.

R. R. Porterfield, general manager of Canadian Gulf, said the company may take the action for lack of a market for the gas.

"It (limiting exports to Peace River) will retard or even stop a major expansion program now under way in the Pincher Creek area, handicap the agricultural industry, and delay industrial as well as oil and gas development in Alberta."

Lack of a gas market in southern Alberta would clamp a tight lid on the search for additional gas fields in the area where the largest gas reserves exist, Porterfield said.

"Texas and other gas-producing states in the United States did not increase their reserves from 23 trillion cubic feet in 1925 to 194 trillion in 1951 by the denial of markets," he said. "In the past 25 years the United States has marketed more than three times the estimated reserves of 1925 and during the same period has increased reserves eightfold."

Pincher Creek, Canada's largest gas field, has not been produced to date for lack of a market. Canadian Gulf at last report had four gas wells in the field and was drilling three more. The company's present program, estimated to cost about $15,000,000, provides for drilling more wells and building processing and extraction plants.

Meanwhile, N. E. Tanner, minister of mines, said he has been informed

by Canadian Gulf that it will proceed with its program in Pincher Creek despite the government's present policy on exports.

Carbon-Black Plant Started

SARNIA, Ont.—Foundations are being poured for the $2,000,000 furnace-type carbon-black plant of Cabot Carbon of Canada, Ltd., here.

The plant is scheduled to go into production early in 1953 and will cost an estimated $2,000,000.

It will be the first plant in Canada to manufacture carbon black for use in rubber processing.

First Cracker on Stream

SARNIA, Ont.—Ontario's first fluid catalytic cracker has been placed on stream at the newly completed Froomfield refinery of Canadian Oil Companies, Ltd.

The new plant was placed in operation after circulating "cold oil" on the 90 per cent level for more than a week.

Operation of the crude unit and Platformer at the 20,000-bbl. refinery will follow closely.

River Crossing Contracted

MACRORIE, Sask.—Interprovincial Pipe Line Co. has awarded contract for construction of a second crossing of the South Saskatchewan River near here to Sparling-Davis Co., Ltd.

R. E. Trammel, general manager of Interprovincial, said the 6,700-ft., 20-in. crossing will have a minimum cover of 15 ft. through the river bed.

Construction will begin after flood season when the low-water level of the river is reached. It should be completed before September 30, Trammel said.

WEST COAST

Subsidence Attacked Anew

LONG BEACH.—Subsidence in the harbor area of Wilmington field may be attacked from a new direction in the future.

The Long Beach Harbor Commission has authorized a $40,000 study to determine the feasibility of injecting water into the many fault-block reservoirs which make up the field.

The primary purpose of the study, which is to be made by Dr. John F. Dodge, Los Angeles consultant, will be to determine whether or not water injection will help maintain reservoir pressures and increase ultimate oil recovery. As an added benefit it is hoped the project will halt, or at least check, land sinkage in the harbor area.

Subsidence already has lowered some areas as much as 15 ft., and engineers expect an additional 7 ft.—the trouble is most pronounced. To offset this sinking, between 4,000 and 5,000 tons of earth daily is being trucked in to bring the land area up to the level of the dikes. In some areas fills as much as 18 ft. in depth are being made. Cost of the remedial work, including that of elevating the surface equipment of hundreds of oil producers and the relaying of many pipe lines, is estimated to be in the vicinity of $20,000,000.

If found feasible and authorized by the Harbor Commission, the water-injection project may be undertaken in connection with a proposed gas-injection program. The latter, now in the pilot-plant stage, may involve return of some 20,000 M.c.f. of gas daily for the purpose of maintaining reservoir pressures as well as storing surplus gas.

Oil Deal Pending

General Petroleum buying San Ardo field production

LOS ANGELES.—General Petroleum Corp. has announced it is negotiating for the purchase of the San Ardo properties now operated by Jergins Oil Co.

Involving about 135 wells which currently are producing about 10,000 bbl. daily, the deal calls for cash and payments out of oil production to aggregate $36,000,000.

According to a statement by R. L. Minckler, president of General Petroleum, agreement has been reached with General American Oil Co., Dallas, for its half of the jointly owned properties.

The company is contracting with Monterey Oil Co. and Wilmington Associates, Inc., for the purchase of the other half when these two companies receive the San Ardo interests from the now-dissolving Jergins Oil Co.

Located in the Salinas Valley about 5 miles south of the town of San Ardo, the developed portion of the field is almost entirely owned by the Jergins-General American group and The Texas Co.

Current production of the field is about 21,000 bbl. daily, coming from approximately 290 producers. Nine rigs are at work there, adding about 20 new wells monthly.

Recent development.—About 200 of the San Ardo wells have been drilled in the past year, following the announcement of General Petroleum that it was giving the field a pipeline outlet to Estero Bay. This 8-in. line has been in operation since the middle of last year.

A looping program scheduled to be completed about May 1 will increase the line's capacity from 20,000 to 25,000 bbl. daily. Because of the viscous nature of the 12°-gravity crude, both heating and blending are used to facilitate pumping.

Development of the field's principal pay zone, the Lombardi sand, has been on an orderly 10-acre well spacing. Along the northern flank and in local areas of the field, a deeper pay, the Aurignac sand, also is being developed. Oil reserves of the field, which may have a productive area of about 3,500 acres, have been estimated from a low of about 70,000,000 bbl. to as much as 200,000,000 bbl.

Union Deep Test Connects

LOS ANGELES.—Union Oil Co. has come up with a deep Sespe sand discovery in old Torrey Canyon field near Piru in Santa Clara Valley.

The discovery, 83 Torrey, was being completed as a pumper after swabbing fluid at the rate of 40 bbl. per hour, most of which was 17°-gravity crude.

Bottomed at 9,327 ft., the deep test cored about 1,200 ft. of Sespe oil sand before drilling was halted. As in other wells drilled in that area, however, comparatively little of the section is believed to be oil productive.

Located near the center of the old Torrey Canyon field, where Sespe oil production at about 2,500 ft. was first found in 1889, the wildcat attracted widespread attention in the California press. Union officials, however, were quick to discount the importance of the 1,200-ft. oil section because of previous experience with the nonmarine Sespe sands.

The company shortly will get under way on a second deep test about 2 miles to the southeast, location for which was announced about a month ago. It will be 17 Simi in projected 3-3n-18w. Union holds about 30,000 acres in fee in the area.

Airport Leasing Studied

LONG BEACH.—Details for leasing of some 1,000 acres of city lands at the municipal airport and contiguous tracts are being prepared by the Long Beach city manager's office. Bids are to be invited for the leases with all drilling to be slanted from certain restricted areas or "islands."

In 1947 and since, drilling activity in Signal Hill south and west of the airport has indicated possibilities of oil underlying the airport. Because of then existing leases to the Air Force, however, no development took place. Approval for the program, which would not interfere with airport activities, has been given by the Civil Aeronautics Administration.

SPEAKERS AND THE PRESIDING OFFICER at the S.G.A. transmission session included, left to right, J. J. Hogan, Mathieson Hydrocarbon Chemical Co.; August Belmont, vice president of Dillon, Reed & Co., Inc.; Claude A. Williams, president of Transcontinental Gas Pipe Line Corp.; and A. L. Roberts, Texas Gas Transmission Corp. Roberts served as chairman of the session.

High Prices—More Gas

Higher field rates, raised through competition, will assure adequate supplies, S.G.A. told; export critics challenged

Walter Rose

GALVESTON.—Field prices for natural gas are too low, but they should be raised through free competition and not by statute, Ernest O. Thompson, Texas Railroad Commission member, told the Southern Gas Association here last week.

Higher prices, Thompson said, will guarantee an adequate supply of the fuel, will improve conservation efforts, and will provide long-term benefits to consumers.

Fixed prices, on the other hand, whether by federal or state law are "undesirable and unworkable," Thompson said, for these reasons:

...**Prices fixed by statute** soon would be obsolete.

...**Increases in field prices** in the open market, together with escalator clauses and other factors, have made price fixing unnecessary.

...**Fixed prices** would repeal the natural law of supply and demand and would pave the way for fixing prices for other natural resources and articles of daily use from "goobers to watermelons."

...**Statute pricing** would be a step toward government control of business and industry and would lead toward a "fuel dictatorship."

...**Free prices** established by open bidding will cause new reserves to be found.

While a large portion of present reserves were discovered incidentally during a search for oil, at a time when gas was unwanted, this country cannot depend on such "accidental discoveries" for its future supply, Thompson told the gas men.

"The well-head price of gas should be adequate to encourage independent search and wildcat drilling for gas on purpose.

"Let gas prices be self-sustaining.

"A free, fair, competitive price will get the gas discovered, produced, processed, transported, and distributed," the commissioner declared.

Exports defended.—Answering criticism within the state against permitting movement of Texas gas outside the state's borders, Thompson said any market for new gas discoveries is welcome.

Markets for Texas oil are hunted all over the globe, Thompson said, adding that natural gas "has just as much right to hunt for a market as has oil" and that gas is "no more irreplaceable than is oil."

Nobody, he suggested, is offering to pay a gas producer to hold his gas reserves that "somebody might some day possibly want for some prospective plant that might come to the area." Any city or chamber of commerce or state or local government which is worried about a future gas supply can go out now and but whatever reserves it wants and hold them, he declared.

Consumer benefits.—Primary concern of a gas consumer, Thompson told the gas men, is a long-time dependable supply.

An increase in the well-head price would guarantee this by providing the incentive needed to make companies go out and look for new reserves.

Anyhow, Thompson said, a 5-cent per M.c.f. increase at the well head would mean no more than a increase in price to the consumer of 25 cents a month, which is a small price for the homeowner to pay for assurance that he will not have to change his home appliances from natural gas to another energy source.

In the past 7 years, he added, Texas reserves have been increased from 72 trillion cubic feet to 105 trillion cubic feet in spite of increased production.

"These are the sort of figures the consumer wants to hear for reassurance and guarantee of his long-term gas supply. He is not greatly concerned over an added cost of 1 cent a day for this guarantee."

This increase in reserves, Thompson declared, was a direct result of a well-head price increase to 10-15 cents per M.c.f. from the old price of 3 to 5 cents.

Expansion Roadblock

The 6 per cent return on investment will reduce dividends of gas-carrying firms, make financing difficult, S.G.A. hears

GALVESTON.—Limiting the natural-gas-transmission companies to a 6 per cent return on investment will make it difficult to achieve needed expansion, members of the Southern Gas Association were told here last week at the organization's forty-fourth annual meeting.

Claude A. Williams, president of Transcontinental Gas Pipe Line Corp., said expansion of the industry under conditions of a limited rate of return would result in reduced dividends. This would mean, he said, that common stock could not be sold at an attractive price and that the mortgage requirements would be such that it would be difficult to borrow money.

The attitude and philosophy of members of the regulatory bodies, he said, makes it apparent that the rate-of-return question cannot be settled on an industry-wide basis but must

be handled on a company-by-company basis.

Williams' beliefs were echoed by August Belmont, vice president of Dillon, Reed & Co., who said a 6 per cent return would not provide the money needed to finance the gas-transmission industry in its future expansion.

Belmont estimated that expansion costs during the next 5 years would total 5 billion dollars.

Regulatory authorities, Belmont said, sooner or later will "be forced to recognize the inadequacy of 6 per cent as a rate of return sufficient to allow the industry to finance its needs."

Costs vs. price.—Although the price of gas today is about the same as it was 15 years ago, higher prices must come soon, Charles E. Bennett, president of the American Gas Association, told the meeting.

"While living costs climbed nearly 90 per cent, as government figures show, gas service to consumers has advanced only 3 per cent," Bennett said.

Since 1940, he added, the average pay check of the gas-utility employe has more than doubled and the industry's total tax bill has risen from $140,000,000 to a 1950 total of $340,000,000, but few companies have been granted rate increases that would even begin to compensate for the tremendous increase in costs that the industry has been absorbing.

"Tremendous outlays of new capital are going to be needed to finance the huge construction program planned for the next few years to serve our greatly expanding industry," Bennett said.

New field for gas.—The booming petrochemicals industry was cited by G. R. Walton, of United Gas Pipe Line Co., and J. J. Hogan, of Mathieson Hydrocarbon Chemical Co. as a growing consumer of natural gas and one which offers the gas industry a promising future. *(Hogan's paper will appear in the May 19 issue of The Oil and Gas Journal.)*

Walton said at present about 80 per cent of the consumed gas is used as a source of heat and about 20 per cent as a raw material. Hogan told his audience that the chemicals which can be produced from natural gas "are almost endless in number."

Walton said principal uses of gas now are in the evaporation of liquids, drying of solids, calcining, inert atmosphere generation, and the cracking of hydrocarbons.

As examples of the importance of gas in petrochemical operations Walton said 60 M.c.f. is required for producing a ton of chlorine, including 35 M.c.f. for fuel and 25 for processing and purifying; 70 M.c.f. is required to make a ton of ammonia; 330 cu. ft. is required to make a gallon of methanol; 25 cu. ft. is needed to make a pound of formaldehyde; and 73.5 M.c.f. is required to manufacture a ton of methyl chloride.

New officers.—J. H. Wimberly, Houston Natural Gas Corp., was elected president of the association to succeed L. L. Dyer, of Lone Star Gas Co.

H. K. Griffin, of Mississippi Gas Co., was named first vice president, and C. I. Wall, West Texas Gas Co., was elected second vice president.

Five new directors and two members of the advisory council also were elected.

New directors are Hansell Hillyer, South Atlantic Gas Co.; William D. Mastin, Robertshaw - Fulton Controls Co.; Ely R. Cunningham, Texas Eastern Transmission Corp.; Williard G. Wiegel, Lone Star Gas Co.; and Duncan C. Crawford, Atlantic Gas & Light Co. New members of the advisory council are C. H. Vachry, Southern Union Gas Co., chairman; and J. C. Flanagan, United Gas Corp.

The meeting was attended by 1,470 registrants, a new record for the annual meeting. New Orleans was selected as the host city for the 1953 meeting.

Price Control Panned

I.P.A.A. attacks it as unrealistic and unwarranted, but OPS speaker says decontrol of crude is not in the cards

Bertram F. Linz

COLUMBUS.—Control of the price of crude oil was attacked by the Independent Petroleum Association of America at its midyear meeting here and also was defended by an official of the Office of Price Stabilization who addressed the association.

The attack on price control was touched off by Charlton H. Lyons, I.P.A.A. president, in his opening address when he told the membership there was no justification under the Defense Production Act for the imposition of price ceilings on crude oil.

"There is no shortage of oil," Lyons asserted. "There is no threat of an unreasonable increase in the price of crude oil if it is decontrolled."

Lyons charged that the real aim and result of every planned economy are to deteriorate the economy and destroy capitalism, but he emphasized he was not aiming at PAD which he commended highly for doing a good job.

No need.—In a statement adopted by the directors it was asserted there is no need for price control since oil is in ample supply to meet all current needs, intense competition in every phase of the industry prevents unreasonable price increases, and there is no shortage or threatened shortage which could result in unreasonable increases in prices through scare or speculative buying.

Assailing the policies of the Office of Price Stabilization, the statement said "experience has demonstrated the dangers of such unrealistic price policies" which during the last war "brought this nation to the brink of an oil shortage in the immediate post-war period."

Cost study.—Increased costs of production warrant a higher price for crude oil, it was asserted in a report brought in by the association's committee on cost study.

Net cost of production, without consideration of depletion, has increased 31.5 per cent in the 4 years 1948-51, in which there was no change in the level of crude prices, it was indicated by the committee. This is equivalent to an increase of 58.4 cents per barrel of company-interest oil produced.

The committee found that the increase in activity and cost factors in the last quarter of 1951 over the same quarter in 1947 were 84.2 per cent in number of exploratory tests, 96.4 per cent in footage of dry holes drilled, 31.8 per cent in productive footage drilled, 43.5 per cent in wages and salaries, and 30.8 per cent in the composite wholesale price per pound of finished steel.

"However," the report commented, "partially offsetting these increased costs, domestic production rose 20.4 per cent from the fourth-quarter average of 1947 to the fourth-quarter average in 1951. It should be remembered that not all producers shared in this increase in production. For many producers in a great number of fields and areas, there has been no increase in production to offset the increased costs. This group is in an even more unfavorable position than is indicated by the over-all figures."

Replacement costs.—The committee is making a study of replacement costs, but was not prepared to submit any report to the midyear meeting. However, it said, in view of the increased costs of finding, developing, and producing crude it is obvious that replacement costs have increased to a far greater extent.

Such information as has already been developed demonstrate that if the defense program is to be met, there must be official recognition of replacement costs, the committee asserted. In the last 2 years more than 75 per cent of the domestic production came from fields found prior to the last war, nearly one-third from fields found earlier than 1930.

"Adding the cost of material factors to the increasing amount of drilling necessary to find new oil, it should

be obvious that the cost of replacement today of great volumes of the oil that is now being produced from low cost fields would be far greater than that reflected on the books of the industry," the committee commented.

OPS' defense.—Defending price control, Edward F. Phelps, Jr., director of price operations of the OPS, said the burden of proof for a general price increase rests with the industry and that on the basis of past, present, and prospective production there is nothing to suggest that present prices are a problem in keeping output up.

Phelps asserted that no one suggests the present drilling goal will not be met and expressed a belief that increased drilling is prevented only by the shortage of steel. There is a difference of opinion in the industry, he said, whether an increase in price would determine anything.

Go to Congress. — However, Phelps said, if the industry can convince Congress of the need for writing specific provisions for decontrol into the Defense Production Act, that is a different matter. But, he said, OPS can't ask the steel industry to absorb certain cost increases out of income and at the same time let the oil industry pass increases along in higher prices.

On the other hand, Phelps said, OPS has the means for dealing with area or individual problems and is working on them all the time. Under that policy 27 situations involving 54 different fields have been dealt with and prices have been established for 462 new fields brought in since the price freeze.

Phelps told the association the OPS standards have hardly been tested on the oil industry, which has had a "reasonably benevolent kind of price control." East of the Rocky Mountains, he said, the average price of crude has increased from $1.04 per barrel in 1940 to something approaching $2.64, suggesting a substantial increase, even though prices have been fairly stable since 1948.

Burden of proof. — "The burden is simply going to have to rest with you to show that higher crude prices on the average are justifiable or appropriate under a short-term price stabilization program," he declared. The steadily increasing production rate, he said, suggests that price is not interfering with the normal and substantial increase in necessary production.

Phelps explained that the earnings standard, providing for an increase in industry prices generally when an industry's earnings fall below 85 per cent of the best three out of four base years, can be applied to oil, either as an industry or in segments or special sections, but again the burden of proof of the need for such relief will rest on the industry—to prove that crude prices are not returning all they should in relation to that standard.

Citing the steel situation, Phelps said the industry could have absorbed the entire amount of the Wage Stabilization Board recommendations with only slight reduction in net earnings and charged that the industry, in effect, has transferred to its customers and eventual consumers all of the heavy tax burden Congress voted to support the defense program.

He suggested that for one reason or another oil has been able thus far to do approximately the same thing, saying the figures suggest that earnings after taxes are higher than they were and, with few exceptions, are continuing to rise. That means the tax load hasn't bitten with very much force, he said.

Demand Prediction

I.P.A.A. says third quarter will average 7,418,000 bbl. daily, a 4.2 per cent increase over same period last year

COLUMBUS. — Total domestic and export demand for products during the current and third quarters will average 7,418,000 bbl. daily, an increase of 4.2 per cent over the same period last year.

For the last quarter of this year and first quarter of 1953 the demand will be 8,287,000 bbl., an increase of 3.4 per cent.

These predictions were made at the midyear meeting of the Independent Petroleum Association of America by its economics committee, headed by Harold B. Fell, of Ardmore, Okla.

Inventories of crude and products are expected to accumulate at an average rate of 360,000 bbl. daily during the summer months in anticipation of peak seasonal demands next winter, and to drop during the heating-oil season at a rate of about 314,000 bbl. daily as inventories are utilized to meet a portion of those demands, the committee said.

On the basis of these figures the committee estimated that the total required supply will average 7,791,000 bbl. daily during the current quarter, 7,765,000 during the third quarter, 7,943,000 during the final quarter of this year, and 8,003,000 in the first quarter of 1953.

"The committee believes that it is unreasonable to expect the rapid increases in demand which have materialized during the past 2 years to continue during the immediate future," Fell reported. "The estimates made by the committee approach more closely the long-term or normal increases in demand as experienced in the industry. On this basis, then, it must be reasonably expected that production and runs to stills will also increase at a slower rate than has been the case in recent years."

All of the estimates, Fell emphasized, are based on the assumption that industrial production will continue at approximately current high levels; no marked change will take place in the international situation, production and refining in Iran will remain shut down, weather conditions, particularly next winter, will be normal, and no major strikes will occur.

Details of the committee's estimates are shown in the accompanying table.

U. S. PETROLEUM SUPPLY AND DEMAND FORECAST
(In thousands of barrels)

	1st. Q 1952	2nd. Q 1952	3rd. Q 1952	4th. Q 1952	Year 1952	1st. Q 1953
DEMAND						
Gasoline	2,925	3,420	3,510	3,255	3,279	3,000
Kerosine	500	250	250	485	371	510
Distillate	1,880	1,045	1,010	1,640	1,393	1,980
Residual	1,800	1,525	1,440	1,730	1,623	1,815
Other	1,030	1,140	1,245	1,110	1,131	1,050
Total demand	8,135	7,380	7,455	8,220	7,797	8,355
EXPORTS (included above)—						
Gasoline	95	90	75	65	81	60
Kerosine	20	15	10	15	15	10
Distillate	60	55	45	40	50	30
Residual	70	70	60	50	62	35
Other products	70	65	65	60	65	60
Crude	70	65	60	60	64	60
Total exports	385	360	315	290	337	255
Domestic demand	7,750	7,020	7,140	7,930	7,460	8,100
TOTAL STOCK CHANGE	—251	+411	+310	—277	+48	—352
TOTAL NEW SUPPLY REQUIRED	7,884	7,791	7,765	7,943	7,845	8,003
CLOSING STOCKS: (million barrels)—						
Gasoline	159.0	141.0	125.0	135.0	135.0	160.0
Kerosine	16.5	27.0	37.0	28.0	28.0	17.0
Distillate	48.5	78.0	108.0	92.0	92.0	53.0
Residual	37.0	43.0	51.0	46.0	46.0	40.0
Other products and natural gasoline	89.0	96.5	93.0	89.5	89.5	90.8
Crude	260.0	262.0	262.0	260.0	260.0	258.0
Total stocks	610.0	647.5	676.0	650.5	650.5	618.8
RUNS TO STILLS	6,675	6,702	6,735	6,816	6,732	6,832

MIDDLE EAST

New Attack on Pricing

Request for Justice Department action against three big firms seen as new federal move against accepted policy

Dahl M. Duff

THE Mutual Security Administration's claims of overcharges on Marshall Plan shipments represents a renewed attack on accepted industry pricing policies in the Middle East.

The existing price for crude oil in the Persian Gulf and the Eastern Mediterranean was first questioned about a year ago *(The Oil and Gas Journal, March 8, 1951, page 62)*. Last week, MSA announced it was turning over the matter to the Justice Department, apparently for civil suits on the claims. The three United States companies involved all denied any irregularities and pointed out the question was one of interpretation of the regulations.

Companies making Marshall-Plan shipments of oil have provided a certificate stating that the price charged is no higher than the prevailing competitive level. The gist of the ECA-MSA claim is that the discounted sales made by Arabian American Oil Co. to its parent companies should be the general price. Furthermore, the agency is understood to contend that a pipe-line charge rather than the corresponding tanker rate should be the basis for the mark up on oil moved through Tapline.

Present crude price in the Persian Gulf is $1.75 a barrel for 36°-gravity oil. The ECA-MSA claims for overcharges cover shipments from May 3, 1949, to December 31, 1951, and in the aggregate amount to some $50,000,000. The Department of Justice is studying the claims and has retained Sam Nakasian, a former price official with ECA. Nakasian has been an adviser to the Iranian Embassy during the nationalization dispute.

Companies involved.—The three United States companies involved are California-Texas Oil Co., Ltd., Socony-Vacuum Oil Co., Inc., and Esso Export Corp. Caltex represents Standard Oil Co. of California and The Texas Co. owning together 60 per cent of Arabian American Oil Co. Esso Export represents Standard Oil Co. (N. J.) holding another 30 per cent, while Socony-Vacuum has the remaining 10 per cent. The statement made by officials of these companies in New York after the Washington announcement of MSA follow:

Caltex.—"The claim against Caltex . . . originates . . . from a difference in the interpretation of the MSA law and regulations. Caltex believes that it will have no difficulty in demonstrating its complete conformance . . . and the propriety of the prices at which its oil was sold. . . ."

Jersey Standard.—"All of Esso Export's sales to purchasers in ECA countries . . . have always been at competitive prices. These prices are well known and have not been questioned by any of the countries or customers involved. This entire subject has been discussed thoroughly at frequent conferences with ECA in which it was pointed out that, in the opinion of Esso Export, ECA was attempting to interfere with normal competitive prices. Because of the vital importance of the principle involved—free competition in world markets—Esso Export intends to defend its position as strongly as it can."

Socony-Vacuum.—"We have conducted our business with ECA-assisted countries entirely in accord with proper practices and with regulations promulgated by ECA . . . We assume (the claim) involves questions raised about a year ago by ECA people. In February and March 1951, representatives of Socony-Vacuum met with ECA officials in extended conferences in an attempt to resolve these questions. We believed that as a result of these conferences the ECA had a better understanding of the problem and would either accept our explanation or call for further discussion. We heard no more about the matter until recently when we received a letter saying that the MSA, successor to ECA, had requested the Department of Justice to take action with respect to a claim for about $10,300,000 against Socony-Vacuum. The arguments we presented to the ECA more than a year ago have not been refuted, and we are confident they cannot be."

Company position.—The defense of the companies against the MSA claims revolve around several points.

In the first place, neither the ECA nor its successor, MSA, were set up by law as a price-fixing agency in international trade, and it is contended that the effect of its present action would be exactly that. As far as the lower price to Aramco's parents is concerned, this is held to be an accepted and recognized practice for long-term contracts taking large quantities of material. The system on Eastern Mediterranean pricing follows the normal procedure of meeting competition at destination.

Existing competition between the companies operating in the Middle East has prevented the price at Sidon, the Tapline terminal, from following the changes in the time-charter tanker market. The price was originally set at $2.41 reflecting the $1.75 price in the Persian Gulf plus the difference in tanker rates at that time between the two points as determined by the Broker's Award, a panel of tanker brokers in London which assesses the time-charter market semi-annually.

Originally there were some slight differences in the prices at Sidon between the three offtaking companies, but they quickly came down to the common $2.41 level. This occurred early last year shortly after Tapline opened. The price has remained at this figure since then, despite the fact that tanker market, even on the more stable basis of the Broker's Award, has advanced considerably.

The effect of this unchanged Sidon price has been to throw the price structure in the Middle East somewhat out of balance. It placed a premium on Sidon crude as against that taken from the Persian Gulf, itself. This was due to the fact that crude out of Sidon could be laid down much cheaper in, say, France, than could crude from Ras Tanura because of the increase in tanker rates since the Sidon price was established.

While these prices deal immediately only with Arabian crude, they affect all prices in the Persian Gulf which must be competitive. The price at Tripoli, the terminus of the Iraq Petroleum Co., Ltd., line, is the same as that at Sidon. However, MSA and its claims of overcharges are concerned only with the dollar-financed oil shipments out of Saudi Arabia or the Tapline terminal.

In the view of some officials in the industry, the ECA-MSA action holds the threat of undermining the whole structure of prices in the Middle East. It was largely under ECA pressure that the price for crude was brought down from $2.18 to $1.75 several years ago.

Production costs.—Statements by various officials over the last year indicate production costs in the Middle East, despite its high per-well productivity, are not much lower than for some of the more flush areas in the United States. This is because of the tremendous investment required in auxiliary facilities and the new 50-50 government participation payments. In addition, there is the large element of political risk. For the producing companies, a forced price lower than $1.75 would further narrow

their return, and as far as the United States is concerned, it would tend to make Persian Gulf crude more competitive with domestic production.

However, there have been various forces recently pressing against the prevailing price level for oil from the Middle East. The Persian Gulf governments naturally are interested in at least maintaining the existing price.

On the other hand, there has been the possibility of below-market sales from the National Iranian Oil Co., if this organization could find buyers, or what is more important, tankers to move its oil away from Abadan. Another factor is the forthcoming sales of 1953 royalty oil by the Iraq Government which is interested in scarce currency, particularly dollars.

I.P.C. Line Finished

New pump stations to move 300,000 bbl. daily

LAYING of the new 30 and 32-in. pipe line of Iraq Petroleum Co., Ltd., has now been completed through its entire 556-mile length from Kirkuk field to Banias, Syria.

First use of the line was made about a month earlier. I.P.C. began filling the line as soon as it was finished from Banias to Station K-3 on the Euphrates River. Excess capacity in the 12 and 16-in. system from Kirkuk to K-3 was utilized, and first crude was lifted from Banias April 11.

Completion of the final 130-mile link from K-3 to Kirkuk field on April 22 will allow a further stepup in capacity of the line. Work on the new pump station facilities continues. When these installations are completed later in the year, the line will be delivering close of 300,000 bbl. daily into Banias.

The final section of the line was laid at point about 50 miles from Kirkuk field. There pipe-line crews, one from the west and the other from Kirkuk, met to mark completion of the project approximately 6 months ahead of schedule.

During the first 10 days of operation of the line, 63,000 tons (about 480,000 bbl.) was shipped from Banias for destinations in western Europe. The first consignment of crude for Britain was scheduled to arrive at the Fawley refinery of Esso Petroleum Co., Ltd., the week end of April 26-27 on the tanker Barren Hill carrying 15,000 tons (114,000 bbl.).

The new 30 and 32-in. line parallels the 12 and 16-in. to Tripoli, Lebanon, for most of its length *(The Oil and Gas Journal, April 7, page 89)*. The last 60 miles are on new right-of-way extending north and west to the new terminal at Banias where six sea lines are used for loading. The last 88½ miles of the line into Banias, downgrade from the point of highest elevation, is 26-in.

LATIN AMERICA

Concession Puzzle

Venezuela, once eager for bids on new acreage, now silent on plans for grants; pending election may provide clue

Dahl M. Duff

FOR reasons best known to itself the Venezuelan Government seems to have shelved the idea of making any early grants of new concession acreage.

More than 4 months has gone by since the government in Caracas asked for and received offers reported to total between $120,000,000 and $150,000,000 for exploration and development rights on areas not now held.

For a while there were almost weekly rumors that the government was about to take action. More recently, however, many of those who had been hoping for quick action have reconciled themselves to a long, and possibly indefinite, delay.

It was to have been the first award of new acreage in the country in the last 8 years. Last December most of the present Venezuelan operators made efforts to protect and expand their existing holdings. Three newcomers — Conorada Petroleum Corp., Cities Service Oil Co., and Superior Oil Co.—all put in bids. Certain choice acreage such as the open block near Mara field was eagerly sought with offers of up to a third royalty.

Reason for delay.—A reasonable assumption of one of the reasons why the present government is holding off is that elections to give Venezuela a constitutional government are planned for later this year. These elections have been promised by the governing military junta, and preparations are now reported being made for registration of the people.

The voting is expected to take place in November. There is no question as to the validity of the present government's decisions, but it is understandable why it would wait on the new government to take action on such an important question as concessions with all its political overtones.

If the delay continues, as now seems indicated, the government could call again for offers, throwing out the bids that were made last December. Some Venezuelans cherish the hope of attracting smaller United States independents into the country to broaden the base of its industry. Whether any of these would be interested later, either singly or in combinations, is an open question.

One fairly accepted view is that time is hardly on the side of the Venezuelans. It is to their interest to receive offers and make awards when the industry is booming and competition for promising acreage is keen. Certainly the slump period of 1949 would have been a poor time. On the other hand, early last winter was a period of high demand and prospective crude shortage due partially to the scrambling to make up the Iranian loss.

The industry on a world-wide basis may now be entering a period of relatively easy crude position. There is talk of an oversupply of crude oil in view of the tremendous expansion of the last year or two and the moderating rate of increase in demand, both in the United States and many areas abroad. A renewed offer of new concessions in Venezuela at a time of crude surplus is not likely to bring in the money that is would have late last year.

Treaty talks. — Discussions are now going on in Caracas between United States and Venezuelan officials on the subject of a new trade treaty. No final agreement is expected for some time, and it is a moot point as to whether these negotiations are contributing to the present concession situation.

Totumal Strike

Fault-separated No. 2 well shows for 75 bbl.

TESTS of International Petroleum Co.'s second well in the promising Totumal area in Colombia indicate a small producer of around 75 bbl. daily of 33°-gravity crude.

International gave this brief report on the well last week. The company said the No. 2 test was located about ¾ mile northeast of the original discovery *(The Oil and Gas Journal, December 6, page 82)* but pointed out it is believed to be in a different structural segment which is separated from the discovery well by faulting. The area is in the middle of the Magdalena River Valley.

Deep test planned.—The company's announcement from its headquarters at Coral Gables, Fla., said it is planned to use a heavy-duty rig on the next well so that it can be drilled through a deeper sedimentary section not yet penetrated by either of the first tests. The operating company is the subsidiary International Petroleum (Colombia), Ltd.

The No. 2 well was drilled to a

total depth of 9,382 ft., according to reports from Colombia, and a 5-in. perforated liner was set between 7,539 ft. and the bottom of the hole.

International's reference to a deeper sedimentary section apparently refers to the base of the Cretaceous limestone from which the wells have obtained production. It is understood that neither the discovery or the No. 2 well has been acidized.

Structurally lower.—The Totumal area is cut by the main fault system which divides the Magdalena Valley from the Andes range. The fault, which separates the two wells drilled thus far, has nearly a kilometer of horizontal displacement and caused the second well to run considerably lower.

Totumal was the first discovery in Colombia west of the Barco concession to produce from the Cretaceous. The No. 1 well tested approximately 1,100 bbl. daily of somewhat lower 27°-gravity crude. It was drilled to 7,217 ft.

Brazil Oil Bill Rejected

The proposal of the Vargas administration in Brazil to set up an integrated half-a-billion-dollar government-controlled oil operation has been turned down by the national-security committee of the Brazilian Federal Chamber of Deputies.

Ironically, the committee based its rejection on the grounds that the measure was too liberal in that it would leave the door open for the entrance of foreign capital. Since the plan was first put before the Congress early in December, the oil industry has indicated little interest in such a nationalistic proposal that would allow it to participate only on a minority basis.

The agency which the bill would create would be called Petroleo Brasileiro and would be empowered to explore, produce, refine, and market oil. Fifty-one per cent of the stock would be government owned, and consumers of oil products (for example, automobile owners), would have been required to buy shares out of the remaining 49 per cent *(The Oil and Gas Journal, February 18, page 100)*.

FAR EAST

New Russian Plant

Coal-hydrogenation unit in Siberia to open in 1953

INFORMATION leaking out of Soviet Russia suggests that the large coal hydrogenation plant under construction near Lake Baikal in Siberia will be completed sometime next year.

The plant later is expected to produce 1,000,000 tons (about 25,000 bbl. daily) of high-quality aviation gasoline. The plant is known to have been under construction since early 1948. Some of the equipment consists of dismantled sections of the former German hydrogenation works at Poelitz near Stettin and Blechhammer (Upper Silesia).

Coal deposits near Irkutsk will be used for the Baikal plant. It is also reported that the operation will employ the Poelitz unit for methane cracking over nickel contact. The 5-year construction period for the plant is due largely to the remote location and the fact that much work is interrupted during winter.

While reports indicate that the Russians have not yet commercially operated coal hydrogenation in the Soviet Union, it is said that a Fischer-Tropsch plant has been placed on stream at Kasakhstan, north of Lake Balkasch.

Operation of the Baikal hydrogenation plant will ease problems now being encountered by the Communists in supplying liquid fuels for military use in Eastern Asia and particularly Korea. Russian oil resources in this area are now believed to amount to less than 30,000 bbl. daily, of which approximately 11,000 bbl. daily comes from crude production in Southern Sakhalin. Other production consists of the output of shale-oil plants in Manchuria.

Some of the deficit between this indigenous production in the region and minimum military and industrial requirements is supplied by tank-car shipments over the trans-Siberian railroad. The Russians, however, have admitted that this line is operating understrain, and considerable oil is understood to be moving by tanker to Vladivostok.

This oil originates partially in Romanian ports on the Black Sea. The voyage to the Far East leads south through the Suez Canal and involves more than 10,000 miles of traveling. Russia has refining facilities at Khabarovsk, inland from Vladivostok.

Sarawak Search Stepped Up

Intensive exploratory work is being carried out in Sarawak by Royal Dutch-Shell in an effort to offset the now-waning Miri field.

Geological and geophysical work is under way over wide areas of Sarawak territory, and two wildcats are being drilled at Bulak Setap and Subis south of Miri in tropical jungle territory.

Miri is one of two fields in British Borneo, both of which are operated by the Shell Group. Miri, discovered in 1910, is in a state of decline. In Brunei, Seria field has been successfully developed since the end of the war and last year produced approximately 100,000 bbl. daily.

One of the two tests now being drilled, the Subis well is accessible to shallow-draft vessels carrying equipment and personnel up the narrow Niah River from its mouth on the China Sea. The Baluk Setap well required construction of a 30-mile road from Miri at a cost of approximately £200,000.

In addition to this program, the operating company has resumed exploration offshore under the South China Sea. Some production has been developed in the past in Seria from wells drilled from jetties extending up to 800 ft. out from the beach.

Guests at the Houston Nomads' Meeting

Representatives of companies operating outside the United States attending the April meeting of the Houston chapter of Nomads included, left to right, C. L. Smith, Petroleum Service & Supply Co., Maracaibo, Venezuela; Jean P. Rochet, Ste. de Etudes et de Recherches Petroliferes en Tunisie, Tunis, Tunisia; George Cormack, Shell Oil Co., Calgary, Alta.; A. J. Didini, Bahrein Petroleum Co., Ltd., Bahrein Island; and C. F. Watts, Shell Oil Co., Calgary, Alta.

India's Imports Up

Despite the closing of the Abadan refinery from which it formerly obtained more than 50 per cent of its oil supplies, India last year imported nearly 19 per cent more petroleum than in 1950.

Total imports amounted to 3,500,000 long tons, an increase of 550,000 tons over the previous year. The 1951 imports were equivalent to about 70,000 bbl. daily. Of the 1951 imports, gasoline accounted for 700,000 tons (500,000 tons in 1950); aviation motor fuel, 76,000 tons (75,000 tons); and kerosine, 950,000 tons (800,000 tons). Aviation-gasoline consumption cuts imposed in July and August last year, have been eliminated, and the general stock position in India is now considered satisfactory.

India will gain a degree of independence in its petroleum supply in a few years with the completion of the two refineries now planned in the country. Standard-Vacuum Oil Co. is to build a 19,000-bbl. daily plant, and Burmah-Shell, one of approximately 40,000 bbl. daily capacity.

EUROPE

New Plant in Full Production

Britain's first plant designed exclusively for the production of refining catalysts has gone into full-scale production.

The plant is that of Joseph Crosfield & Sons, Ltd., at Warrington. Yearly production is expected to be 10,000 short tons, enough to process oil at the rate of 90,000 bbl. per day.

Crosfield is using a Davison Chemical Corp. process and will supply Esso Petroleum Co., Ltd., Anglo-Iranian Oil Co., Ltd., Shell Refining & Marketing Co., Ltd., Trinidad Leaseholds, Ltd., and Bahrein Petroleum Co., Ltd.

European Imports Double

Net petroleum imports into Western Europe are now more than twice what they were before the war.

Figures of the Organization for European Economic Cooperation show that the net imports by the participating O.E.E.C. countries (excluding Austria, Greece, and Iceland) rose by nearly 15,000,000 metric tons in 1951 to the record total of 66,400,000 tons, or about 1,330,000 bbl. daily.

Gross imports of this group of countries, which comprise virtually all of non-Communist Europe, increased by 20,000,000 tons—greater than any previous year—and reached an all-time high of more than 80,000,000 tons.

Reflecting the buildup of European refining capacity, almost all the entire increase in imports was in crude oil. Petroleum exports from Western Europe were negligible until a few years ago. In 1951, they amounted to 14,100,000 tons, nearly 5,000,000 tons more than during the preceding year.

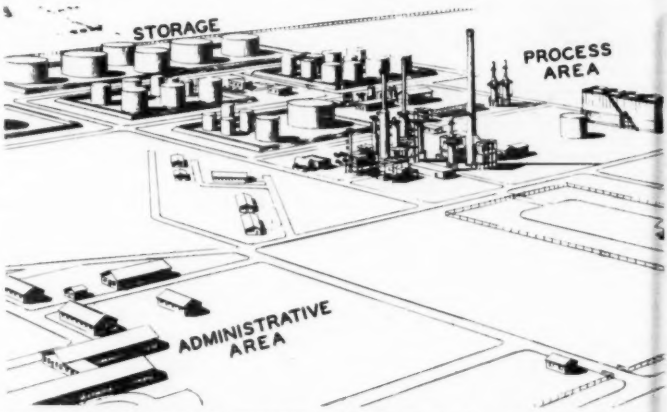
Th total increase in inland oil consumption due to higher industrial production reinforced by rearmament demands and, in the case of fuel oil, to the coal storage, was estimated for the whole area at about 24 per cent. Apart from greater consumption, larger imports of crude oil were necessary in many countries for building up stocks for new refineries.

British Building 109 Tankers

Tankers under construction in the United Kingdom at the end of March totaled a record 1,285,060 tons represented by 109 ships. The tonnage was an increase of 45,463 tons over the amount at the beginning of the year, according to Lloyds.

British shipyards are now building 51 per cent of all tankers under construction throughout the world. Orders with British builders exceed 6,750,000 tons gross, including one-third for direct export, with an estimated currency value of nearly £650,000,000. Tankers represent approximately 56 per cent of all shipbuilding contracts booked in the United Kingdom.

AFRICA



STANDARD VACUUM'S FINISHED PLANT at Durban will look like this when completed. Loading racks for rail and truck movement are out of picture at right.

Stanvac Starting

Construction under way on 15,600-bbl. Durban plant

COMMENCEMENT of construction of the new 15,600-bbl. daily refinery of Standard-Vacuum Oil Co. near Durban, South Africa, was observed in cornerstone ceremonies at the plant site April 25.

The foundation stone for the shop and warehouse building was placed by D. G. Shepstone, the Union of South Africa's administrator for Natal. The plant is expected to go on stream late next year or early in 1954.

Main process feature of the refinery is the new unit which will combine crude distillation, catalytic cracking, and thermal reforming functions. Crude for the plant will be drawn from the Middle East, and production will consist of motor gasoline, power and illuminating kerosines, automotive, marine, and industrial diesel fuels, and light and heavy grades of fuel oil. Foster Wheeler Corp. is the general contractor.

Site for the $17,000,000 plant consists of 285 acres in Wentworth, a Durban suburb. A 4½-in. pipe-line system will connect the refinery to Durban's Island View terminal, where tankers now deliver cargoes of products from Persian Gulf refineries.

The contractor and subcontractors for the project already are well advanced on the transformation of the former Assegai Naval Camp into a major new industry for South Africa.

Grading of the site, involving the moving of 200,000 cu. yd. of earth, is approximately 50 per cent complete. Permanent fencing of the area is nearly finished, and clearing for a rail connection to the South African Railways is under way.

PERSONALS

Association Head

Windfohr long active in Texas conservation work

THE thirteenth man to assume the presidency of the Texas Mid-Continent Oil and Gas Association is Robert F. Windfohr, Fort Worth, independent oil producer.

Windfohr was born in 1894 and was graduated with a law degree from the University of Maryland in 1916.

During World War I, he received his first glimpse of the Southwest while stationed at Fort Sill, Okla., and decided to stay following his discharge.

He moved southward to Breckenridge, Tex., and in 1921 formed the Nash & Windfohr partnership with James P. Nash, Austin oil operator. Their first well, which was drilled near Graham, in Young County, set a record for North Texas. The 4,300-ft. hole was at that time the deepest in the region—but dry.

Since the drilling of their first producing well, the partnership has drilled some 350 wells. In 1930 they brought in a 1,000-bbl.-an-hour producer which is still famous in the history of the Graham area.

Windfohr, who is a partner also in Nash, Windfohr, & Brown, has been active in the petroleum industry's problems for many years. He was a member of the original committee of 55 Texas oil men who championed the state conservation laws at the time of their initiation during the turbulent 1930's. This committee was called by the late J. D. Collett of Fort Worth, who was one of the early presidents of the Texas Mid-Continent.

Herbert B. Smith and **J. W. Jordan,** both vice presidents and directors of Sinclair Oil & Gas Co., have been elected executive vice presidents. Smith will be in charge of all exploration activities, and Jordan will serve as chief administrative officer of all other company operations. **Henry Phillips** was reelected president of the company. Three new directors, all of New York, were elected. They are **P. W. Thirtle,** vice president of Sinclair Oil Corp. and a budget officer of the company; **W. F. Dau,** treasurer of the company; and **Harry A. Hassan,** vice president of Sinclair Oil & Gas Co. and of Sinclair Refining Co. Smith and Jordan will continue to make their headquarters in Tulsa.

Jim Dean, formerly scout and geologist for **C. E. Brehm** at Mount Vernon, Ill., has joined the staff of Fox & Fox at Carmi, Ill.

Frank Adams, engineering graduate of the University of Illinois, is now production superintendent for **T. G. Glass** at Mount Vernon, Ill.

Bethel L. Strawn, division engineer at Farmington, N. M., for Indian Drilling Co., has been transferred to Oklahoma City as chief engineer of the firm. **Keith Peverley,** district engineer at Hobbs, N. M., has succeeded Strawn as division engineer at Farmington, and **Jack Amos** has been named district engineer at Hobbs.

William H. Ward, petroleum engineer for Sohio Petroleum Co., has been transferred from Pauls Valley to Edmond, Okla.

Gage Lund, vice president and a director of Standard Oil Co. of California, and **H. F. Davies,** vice president of Richmond Exploration Co., Caracas, left recently on a trip to Saudi Arabia where they will tour operations of Arabian American Oil Co.

P. G. Powell, vice president and manager of drilling operations of Velma Petroleum Corp., Hobbs, N. M., and **I. A. Cottingham,** secretary-treasurer, have become part owners of the firm as a result of a recent reorganization of the company. **Bill Daniels** has joined Velma as assistant to the president, **Leroy Wise.**

James H. McCourt has been named chief geologist for Union Oil Co. of California in the Rocky Mountain region. He replaces **Horace Goodell,** who recently resigned.

Eugene McElvaney, senior vice president of the First National Bank in Dallas, has been elected to the board of directors of Texas Pacific Coal & Oil Co. McElvaney is treasurer of the Texas Mid-Continent Oil and Gas Association and a director of the Tennessee Gas Transmission Co. and Tennessee Production Co.

W. Howard Byer, chief geophysicist with Union Oil Co. of California, has resigned to become a consulting geologist and geophysicist in Calgary, Alta.

Dr. W. C. Howells, former assistant manager of Texaco Exploration Co., is now exploration and development manager for Anglo American Exploration, Ltd., at Calgary, Alta.

T. J. Alexander, Dallas, is president and **John C. Head,** Midland, is vice president of International, Inc., a newly formed oil well drilling concern. The firm plans to operate in West Texas and Latin America.

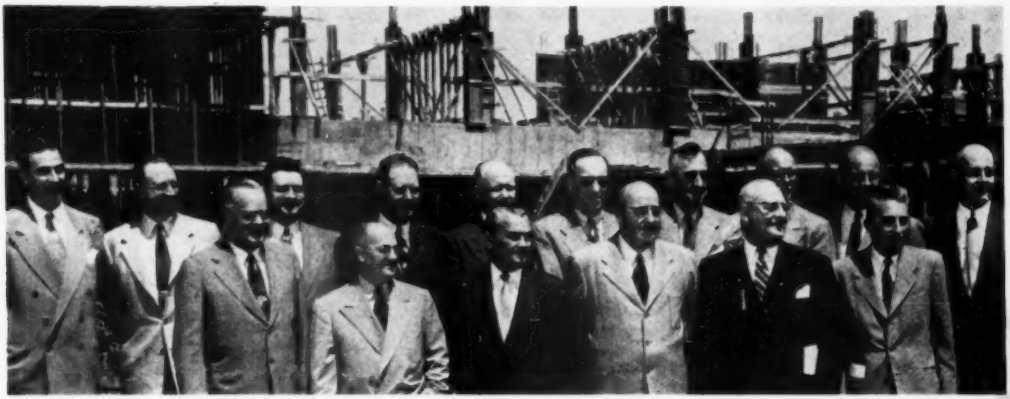
Dr. S. K. Chakravorty, a native of Calcutta, India, has been appointed chief oil and gas conservation officer for Saskatchewan, Canada. In his new position he will be responsible for administration of Saskatchewan's new oil and gas conservation act and will supervise the sedimentary geology division of the minerals branch.

Eskil I. Bjork has been elected president of Peoples Gas Light & Coke Co., succeeding the late George F. Mitchell. Bjork is also vice president of Chicago District Pipeline Co., a subsidiary of Peoples Gas.

H. L. Tipsword, of Magnolia Petroleum Co., has been elected president of the South Louisiana Geological Society. Other officers elected include: **B. H. Dehart,** of Forest Oil Co., vice president; **A. D. McRae,** of Magnolia, secretary; and **Paul Smelker,** of Core Laboratories, Inc., treasurer.

F. A. Calvert, Jr., president of Calvert Drilling, Inc., of Olney, Ill., has been reelected president of the Illinois Oil and Gas Association. Other officers elected include: **A. L. Henderson,** Ohio Oil Co., first vice president; **David R. Stewart,** Moses & Stewart, second vice president; **M. H. Plummer,** Pure Oil Co., third vice president; **E. J. Reading,** Sun Oil Co., secretary; **E. A. Davenport,** Shell Oil Co., treasurer; **Clarence T. Smith,** independent operator, general counsel; and **Charles J. Pardee,** of Mount Vernon, Ill., executive secretary.

PERSONALS



VISITING OFFICERS AND DIRECTORS of Standard Oil Co. (Ind.) and officials of three subsidiaries are shown here as they visited the site of the new Stanolind Oil & Gas Co. research center in Tulsa last week. The Chicago visitors also toured operations in southern Oklahoma. Left to right are, front row: J. L. Burke, president of Service Pipe Line Co.; E. F. Bullard, president of Stanolind, A. C. Sailstad, general manager of sales of Indiana Standard; Dr. R. E. Wilson, chairman of the board; Harry F. Glair, director of purchases; and Max G. Paulus vice president of manufacturing, all of Indiana Standard. Back row, D. F. Benton, vice president of sales; David Graham, financial vice president; J. E. Swearingen, general manager of production; S. A. Montgomery, general manager of manufacturing; J. K. Roberts, general manager of research and development; T. E. Sunderland, general counsel; A. W. Peake, president; F. O. Prior, executive vice president; and R. E. Nelson, Jr., general manager of crude-oil supply and product pipe lines, all of Standard of Indiana; and R. E. Pielsticker, president of Stanolind Oil Purchasing Co.

Vaughn C. Daniel, independent operator at Hobbs, N. M., has opened new offices in Williston, N. D.

Harold Rabling, who for nearly 30 years has been associated with Standard-Vacuum Oil Co. in Australia and New Zealand, has been elected to the company's board of directors in New York.

W. W. Hagan, Owensboro, Ky., has resigned as chief geologist for Felmont Oil Corp. to become an independent consultant.

Lawrence Jackson, formerly located in Hays, Kans., has been named vice president in charge of a new branch office of Lohmann-Johnson Drilling Co. at Calgary, Alta.

M. D. Hughes, chief petroleum engineer for the Long Beach Harbor Department for the past 5 years, has resigned effective June 15 to open offices as a consulting engineer in Long Beach, Calif.

Wayne Wood, geologist for Phillips Petroleum Co. at Corpus Christi, Tex., has joined Panhandle Producing & Refining Co. as South Texas district geologist.

M. M. Tomilin, formerly a senior geologist in the Department of Natural Resources in Saskatchewan, Canada, has been appointed principal geologist in charge of sedimentary geology. **Dr. A. J. Budding,** also a former geologist in the department, is now principal geologist in charge of pre-Cambrian geology.

D. R. Fincher, formerly an associate engineer for Tide Water Associated Oil Co. in Palestine, Tex., has been appointed a gas engineer for the company in Weimar, Tex.

Philip M. Bridges, formerly a research engineer for Stanolind Oil & Gas Co. in Tulsa, has been transferred to Midland, Tex., as a petroleum engineer.

Don D. Baremore has joined Cactus Drilling Co. at Brownfield, Tex., as toolpusher. He formerly was toolpusher for Sharp Drilling Co. at Big Spring, Tex.

J. R. Evans, manager of the North Texas-New Mexico division of Stanolind Oil & Gas Co., has been named a director of the First National Bank of Fort Worth, Tex.

James R. Watson has resigned as production superintendent for James H. Snowden & Associates, Midland, Tex., and is now an independent operator. Watson, who was with Snowden 5 years, will operate in the Oregon, Washington, and eastern Nevada regions. He will make his headquarters in Reno, Nev.

George Bagnall, gas engineer for Magnolia Petroleum Co., has been transferred from Kermit, Tex., to Lovington, N. M.

William B. Macke, formerly of Newport, Ky., has joined the geological staff of Pure Oil Co. at Bismarck, N. D.

William A. Wecker, president and general manager of General Motors of Canada, Ltd., has been appointed a director of British American Oil Co. of Toronto.

Bernard A. Taylor has been appointed district geologist for the Houston district of Sohio Petroleum Co. He joined Sohio in 1946 and has been acting district geologist since October 1951.

William M. Cartmell, consulting geologist of Tulsa, has joined Mohawk Drilling Co. of Oklahoma City.

Ben J. Sorrell, formerly with Ohio Oil Co. at Abilene, Tex., has joined Superior Oil Co. as district geologist.

T. A. van Griethuysen, manager of Continental Oil Co.'s crude-oil trading department since 1948, has been appointed to the newly created position of coordinator of transportation and supplies. He will continue to make his headquarters in Houston. **F. E. Butterfield,** assistant manager

PERSONALS

of the crude-oil trading department, has been promoted to manager. His headquarters will continue to be in Ponca City.

O. B. Manes, area seismologist for Shell Oil Co. at Houston, has been promoted to area geophysicist.

Warren H. Smith, seismic party chief for The Texas Co., has been transferred from Denison to Bowie, Tex.

John M. Cummings, Jr., for the past 3 years on the board of editors of Petroleo Interamericano, Latin American oil publication of The Oil and Gas Journal, Tulsa, has joined Stanolind Oil & Gas Co.'s engineering-training program at Ellinwood, Kans. Cummings is a graduate mechanical engineer from the University of Oklahoma.

Graham W. Aker, a geologist formerly with Magnolia Petroleum Co. in Lindsay, Okla., is now associated with Welex Jet Services, Inc., in Odessa, Tex.

D. B. Taliaferro, Bartlesville, Okla., U. S. Bureau of Mines petroleum engineer, is now in Yugoslavia advising the Yugoslav Government on oil-recovery problems. Taliaferro is on assignment from the United Nations Technical Assistance Mission. He was scheduled to visit Yugoslav fields and give the government oil organization the benefit of his experience, particularly in secondary-recovery methods.

Dale Dorn, vice president of Forest Oil Corp., has been elected chairman of the board of trustees of the Southwest Foundation for Research and Education. He also is a director of Llano Drilling Co.

Kenneth L. Smith, formerly chief engineer and assistant to the vice president in charge of production for Champlin Refining Co., has joined **F. Kirk Johnson,** Fort Worth, as manager of production.

J. B. Pate, pipe line superintendent for Union Oil Co.'s southern division, has been elected president of the Western Pipe Liners Club. **E. L. Dreyer,** of The Texas Co., was elected vice president; and **E. E. Cammack,** of Richfield Oil Co., was elected secretary-treasurer.

Paul E. McGovney, formerly of Honolulu Oil Corp.'s geological office in Bakersfield, Calif., will be in charge of the newly established Billings, Mont., office which will conduct geological and leasing operations for the Williston basin area.

George Berlin, formerly Gulf Coast district superintendent for Skelly Oil Co., has been appointed superintendent of the South Oklahoma district at Velma, Okla.

Thurman L. Jones, seismic party chief for Atlantic Refining Co. at Berwick, La., has been promoted to district geophysicist and transferred to New Iberia, La.

W. L. Morrison has been named production manager for El Capitan Oil Co., and **Edmund Borys** has been named manager of exploration. **R. C. Senning** has been named staff assistant to the general manager and **J. T. Miller** has been made a landman in the exploration department.

John Marshall, Rocky Mountain manager for Anderson-Prichard Oil Corp., has opened offices in Denver. The company recently announced an expanded exploration program for the region.

Frank Morrison, recent geology and petroleum engineering graduate of the University of Oklahoma, is now doing independent consulting work at Mount Vernon, Ind.

A. B. Carlisle, who recently resigned as chief geologist for **C. E. Brehm,** has opened offices at Mount Vernon, Ill., as a consulting geologist. Prior to joining Brehm he had been division geologist for Sohio Petroleum Co. in Evansville, Ind.

S. A. Spencer, party chief for Phillips Petroleum Co. at Waveland, Miss., has been transferred to Thibodaux, La.

Harry A. Larsh, geologist for Shell Oil Co., has been transferred from Tyler, Tex., to Wichita, Kans.

Ed L. Reed, research geologist for Stanolind Oil & Gas Co., Midland, Tex., has resigned and will operate as a consulting geologist. Reed graduated from Texas Technological College in 1939 and joined Atlantic Refining Co. as a geologist. He joined Stanolind in 1942.

William O. Callaway, formerly district geologist for Chicago Corp. at Abilene, Tex., has joined British-American Oil Producing Co. at Fort Worth as district exploration manager.

Harry A. Lutz, technical division manager for Socony-Vacuum Oil Co., Inc., has returned to the East St. Louis refinery after a 6-month leave of absence.

A. C. Yokubaitis, formerly geophysicist for Pan American Production Co., has resigned to become president of Berg Exploration Co., a new Houston firm. **G. A. Berg,** president of Berg Geophysical Co., is vice president of the newly formed company.

DEATHS

A. E. Spielberg, 63, president of Oil Producers, Inc., Grand Rapids, Mich., died recently following an illness of about a year.

Joseph Pierce Philp, 75, Beaumont, Tex., a partner of Philp Bros. Oil Co., died in Beaumont April 24.

Christian O. G. Miller, 86, chairman of Pacific Lighting Corp. and director of Pacific Gas & Electric Co. and American Trust Co., died April 23 in San Francisco.

O. A. Newport, 46, vice president of Texas Empire Pipe Line Co. and Kaw Pipe Line Co. and assistant general manager of Texas Pipe Line Co., died April 25 in Tulsa.

J. V. Doll, 60, vice president in charge of national sales for Mack Motor Truck Corp., died in New York City recently.

Mark Curtis, 67, independent operator of Evansville, Ind., died there recently.

Frank A. Bates, 65, San Angelo, Tex., independent oil operator, died recently in San Angelo.

F. Earl Kearney, 59, superintendent of the gasoline department of Mid-Continent Petroleum Corp., died April 28 in Tulsa.

John J. McMullan, widely known oil operator, died at Douglas, Ariz., April 22.

Wallace Banta Phillips, 66, president of Pyrene Manufacturing Co., died recently in New York.

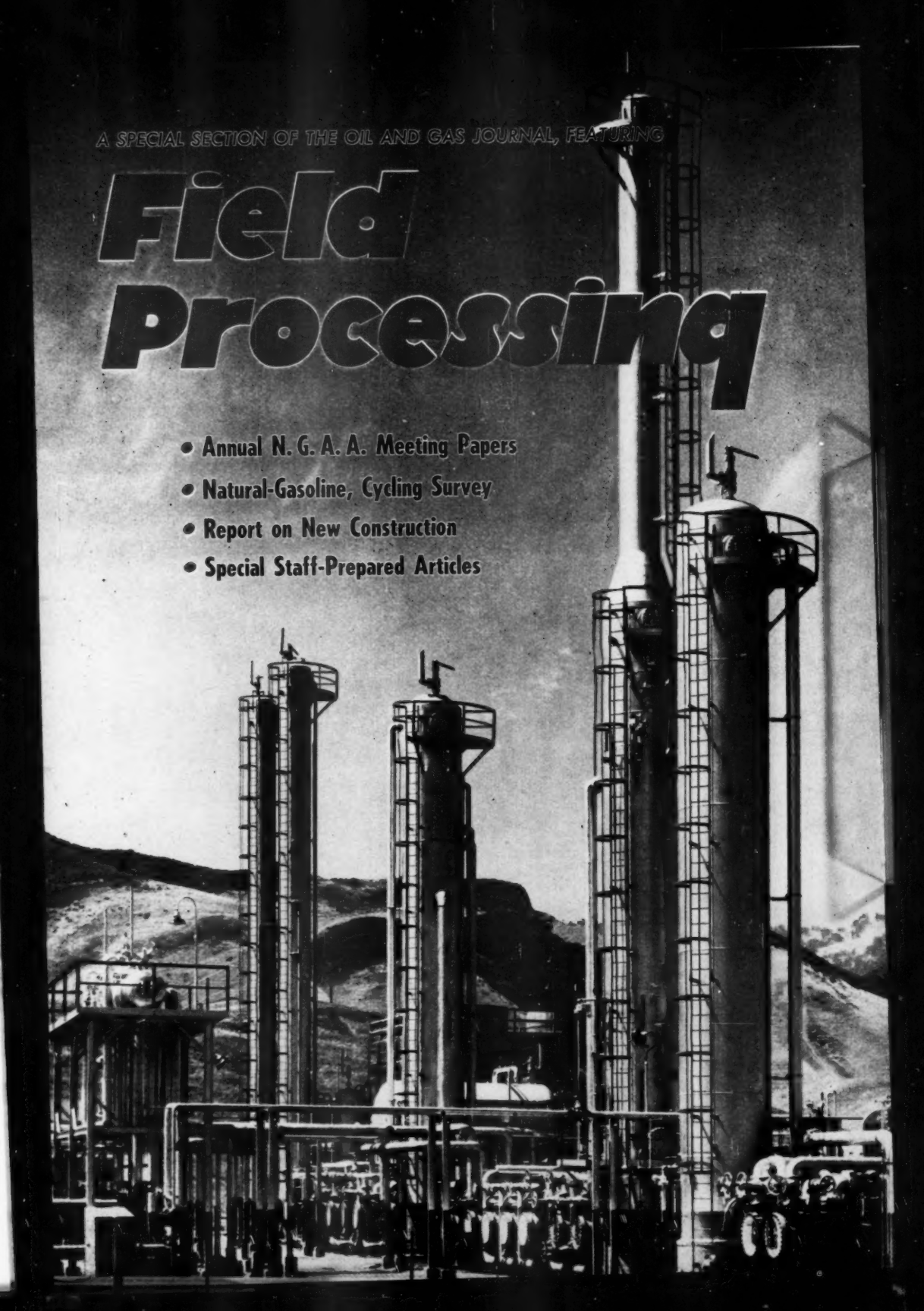
William E. Green, widely known California oil writer, died recently in Azusa. For nearly a quarter of a century Green was California representative for Oil Weekly and later was associated with Contract Drilling magazine.

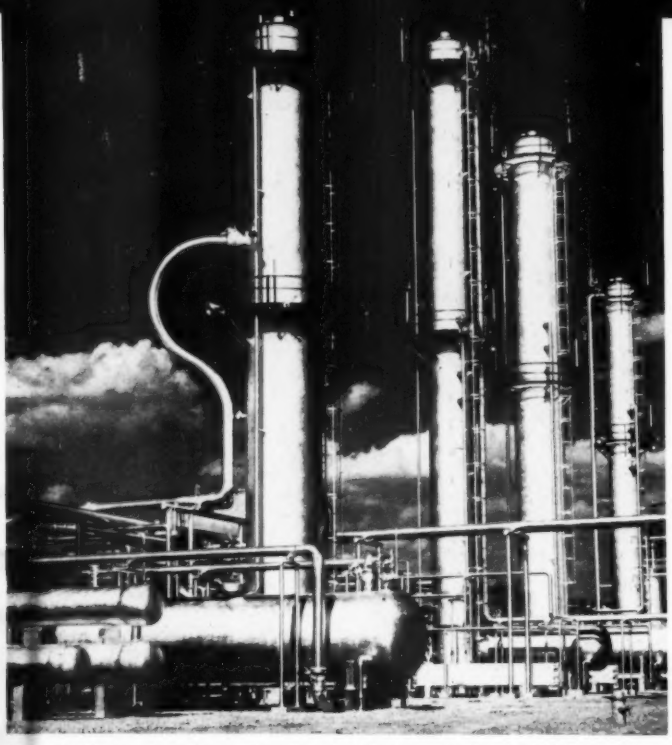
C. Laurence Warwick, executive secretary and administrative head of the American Society for Testing Materials, died April 23 in Philadelphia.

A SPECIAL SECTION OF THE OIL AND GAS JOURNAL, FEATURING

Field Processing

- Annual N. G. A. A. Meeting Papers
- Natural-Gasoline, Cycling Survey
- Report on New Construction
- Special Staff-Prepared Articles





One of Warren Petroleum Corp.'s natural-gas-processing installations where hydrocarbon stripping is used.

How Warren Petroleum Applies

Hydrocarbon Stripping

in its operations

by R. L. Lane* and B. J. Thompson†

USE of the absorption process to extract light hydrogen components from natural-gas and distillate streams has been common for many years. Two decades ago, satisfactory methods of predicting low-pressure absorption operations were available. However, the increasing demand for high-pressure residue gas delivery to gas-transmission companies, the rapidly expanded L.P.G. markets, and the return of gas to oil reservoirs for secondary-recovery purposes have dictated the operation of intermediate and high-pressure absorbers. Many design and operating problems in high-pressure absorption systems still remain unsolved.

Oil Loss

Carry-over or overhead loss of absorption oil in the residue gas stream from the absorber presents several significant problems among which are:

1. The cost of make-up oil lost from the absorption system.
2. The fouling of dry-desiccant-type dehydrator beds.

Various operators have employed different methods of counteracting oil loss from the absorber. These include:

1. Feeding of absorption oil two or more trays below top of the tower.
2. Use of 210 to 230-molecular-weight oil instead of the 160 to 190 molecular weight commonly used in plants extracting high percentages of propane.
3. Internal tray and chimney-type mist extractor units.
4. Use of vane-type mist-extractor elements installed in the top of the absorber, in the residue scrubber and, in some cases, in the residue gas line downstream from the scrubber.
5. Use of mesh-type extractor elements ranging from 4 to 6 in. thick, some of which cover the full diameter of the absorber and others installed

*Chief engineer and †process engineer, manufacturing department, Warren Petroleum Corp., Tulsa. Presented at the annual meeting, Natural Gasoline Association of America, Houston, April 28-30, 1952.

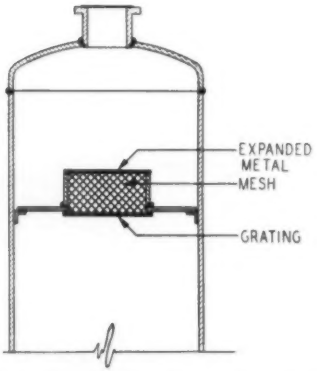


Fig. 1—Schematic arrangement of a mesh-type extractor for absorbers and scrubbers.

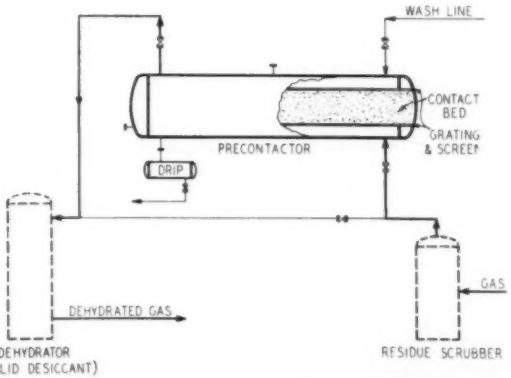


Fig. 2—Hookup of precontactor for solid-desiccant dehydration. Collected oil may be drained manually or automatically.

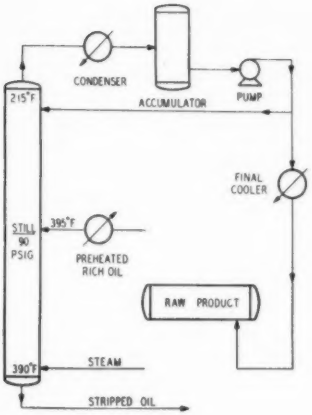


Fig. 3.

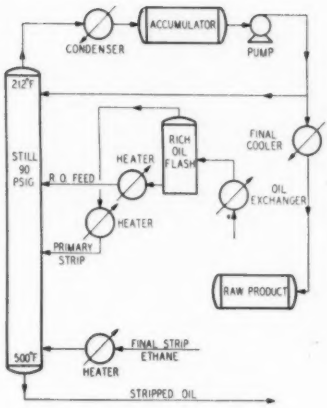


Fig. 4.

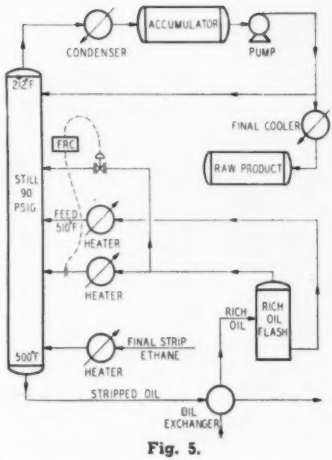


Fig. 5.

in a holding case with a predetermined cross-sectional area based on a gas velocity of 1 to 4 ft. per second.

6. Providing a residue gas contact chamber packed with an absorbing medium such as bauxite.

Various types of extractor elements have been used in Warren Petroleum Corp. installations. Most of these have been found to satisfactorily remove mechanically entrained liquid from gas streams. The problem of removing oil fog from an absorber residue-gas stream has not been solved in our operating experience. In an effort to solve this extraction "toughie," several mesh-type elements as shown in Fig. 1, have been installed in the top section of absorbers and residue-gas scrubbers.

Operating experience has proved that the mesh element must be installed in a horizontal position. Several operating observations show a substantial reduction in the quantity of oil lost overhead from the absorber and residue-gas scrubber when using a mesh-type element.

Use of a precontactor unit as shown in Fig. 2 has proved that significant reduction of oil entering the dehydrator may be affected. Minimizing the amount of oil reaching the solid-desiccant bed extends the ultimate desiccant life and makes possible a lower average dew point of the effluent gas from the dehydrator.

Oil collected in the precontactor drip may be manually or continuously drained. Spent desiccant is a satisfactory material for the precontactor. However, other substances may be employed which provide good absorbing characteristics, such as charcoal, silica gel, and similar materials.

Solid desiccant in dehydrators and precontactors may be regenerated to approach its original efficiency by washing with natural gasoline or butane.

Oils containing aromatic compounds

(Continued on page 255)

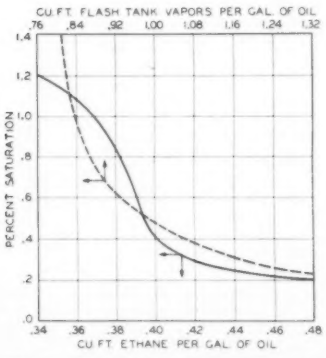

CU. FT. FLASH TANK VAPORS PER GAL. OF OIL
.76 .84 .92 1.00 1.08 1.16 1.24 1.32
PERCENT SATURATION
1.4 1.2 1.0 .8 .6 .4 .2 .0
.34 .36 .38 .40 .42 .44 .46 .48
CU. FT. ETHANE PER GAL. OF OIL

Fig. 6—Absorption-oil saturation data from a plant using hydrocarbon stripping.

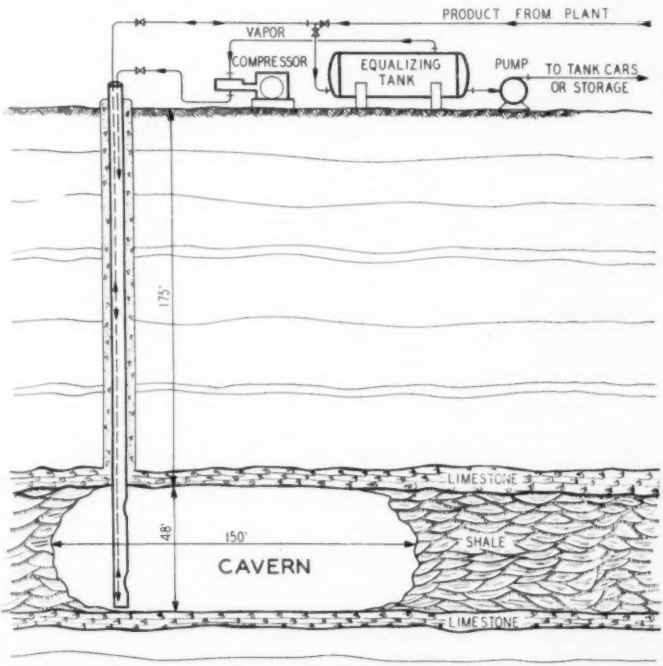


Fig. 7—General scheme for underground storage of L.P.G. Initial recovery from a storage cavern in Stephens County, Texas, ran to about 95 per cent. Subsequent recovery was higher.

Left: Return water plates of gas aftercooler in Plant A, showing scale and corrosion deposits created during phosphate-chromate-sulfuric acid feed treatment.

Below: Same plates after removal of scale and deposits. Pitting attack under the scale is clearly shown.

Use of Surface-Active Agents in

COOLING-TOWER WATER TREATMENT

by W. F. Oxford, Jr.*

Scale forming and corrosion on water side of cooling equipment are sharply reduced by these materials

SURFACE-ACTIVE agents have been used fairly extensively in preventing scale and corrosion in the circulating cooling-tower water of gas-compressor plants.

Large quantities of water are used for various cooling purposes in industry. This may be for cooling condensers or for cooling internal-combustion engines. The source of cooling water may be ground waters, surface waters, or sea waters.

In general, cooling systems may become clogged with scale, corrosion deposits, sediment, and organic growths. The principal scale-forming material in cooling systems is calcium carbonate formed by the decomposition of calcium bicarbonate into calcium carbonate, carbon dioxide and water, as shown in the following reaction: $Ca(HCO_3)_2 \rightarrow CaCO_3 + CO_2 + H_2O$.

The specifications for cooling water vary so widely for various industrial applications that the only general specifications that can be given are that the water should not form heat-insulating scales or other clogging deposits either organic or inorganic, and that it should not be unduly corrosive under the particular conditions of use or reuse. There are three general classifications on the basis of conditions of use as follows:

1. Once-through-and-to-waste system.
2. Once-through and then used for other purposes in cooling systems.
3. Recirculated cooling system.

Cooling-Water Treatment

Cooling-water treatment is rather well known to the art and much information concerning proposed treatments is available in the literature. In general, conventional cooling-water treatment may be effected by one or more of the following processes: (1) acid process, (2) cold lime process, (3) zeolite process, (4) lime-zeolite process, (5) coagulation followed by settling or filtration, (6) iron and manganese removal, (7) aeration, (8) chlorination and copper sulfate treatment, and (9) polyphosphate treatment. These processes are well known to the art of water treating.

It has been found that a mixture of high-molecular-weight substituted glyoxalidines (U. S. Patent 23,227,[2] reissued), known as Kontol, and acylated amino alcohols (U. S. Patent 2,589,195[3]), known as SP-8, is very effective in controlling scale and corrosion in cooling-tower water.

When these compounds are mixed together they exert a synergistic action, that is, neither material when used alone will provide complete control of scale and corrosion in cooling-water systems.

The following laboratory data are offered to show the synergistic action of mixtures of Kontol and SP-8:

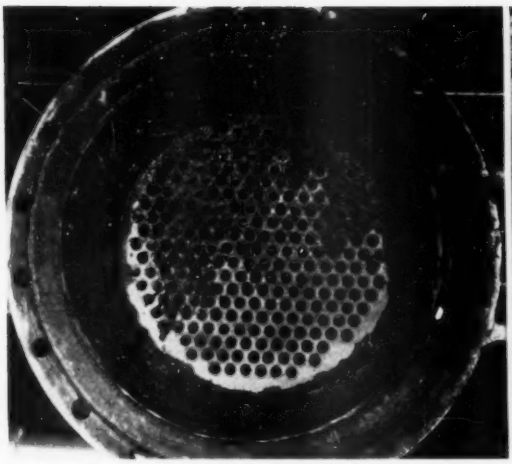
Series I: Kontol 120 in tap water adjusted to pH 8.2—

Concentration, p.p.m.	Penetration rate, m.p.y. (Mils per year)
0	25.8
10	21.4
20	18.8
50	15.2
80	11.8
160	9.2

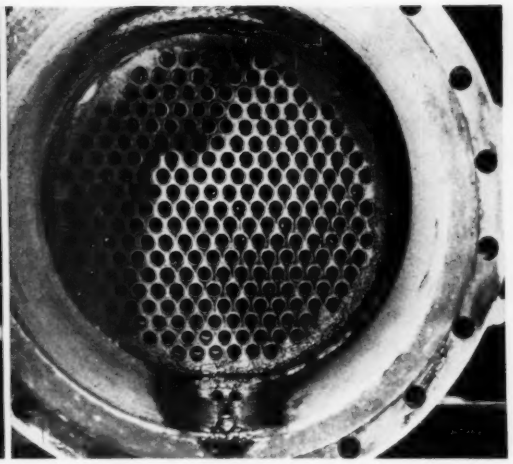
Series II: SP-8 in tap water adjusted to pH 8.2—

Concentration, p.p.m.	Penetration rate, m.p.y.
0	25.8
50	47.0
100	5.8
200	2.0

*Sun Oil Co., Beaumont, Tex. Paper presented at N.G.A.A. annual meeting, Houston, April 30.



Jacket water cooler in Plant A, showing descaling after initiating SP-8-Kontol treatment.



Engine jacket water cooler, Plant A, after 22 months' operation using SP-8-Kontol treatment.

Series III: Kontol 120 and SP-8 in tap water, pH 7.0—

Concentration of each, p.p.m.	Penetration rate, m.p.y.
0	42.2
12.5	43.8
40	10.0

Series IV: Kontol 116 in tap water, pH 8.2—

Concentration, p.p.m.	Penetration rate, m.p.y.
0	25.8
12.5	14.0
25	3.8
50	0.5

Series V: Kontol 116 and SP-8, tap water, pH 8.2—

Concentration of each, p.p.m.	Penetration rate, m.p.y.
0	25.8
25	1.8
50	1.1
100	0.8
200	0.4

Series VI: Kontol 116 in tap water at 120° F.—

Concentration, p.p.m.	Penetration rate, m.p.y.
0	82.5
17	24.4
33	22.2
160	0.4

It is observed in Series I and Series II at 50-p.p.m. concentration, corrosion rates in Kontol 120 alone are to the order of 15.2 m.p.y. and in SP-8 alone at 50 p.p.m. concentration, 47.0 m.p.y. Series III at 40 p.p.m. each Kontol and SP-8 mixture provides a lesser corrosion rate at a smaller concentration than 50 p.p.m. It will also be noticed in Series V that Kontol 116 and SP-8 at 50 p.p.m. concentration each presents m.p.y. value of 1.1. The only difference between Kontol 116 and Kontol 120 is the degree of water solubility.

Earlier data obtained may best be presented by means of the accompanying graph. Curve 1 represents the weight-loss curve of soft iron in circulating aerated tap water. Curve 3 represents the weight loss curve in tap water containing 1:75000 Kontol 120 and 1:75000 SP-8. Note that these curves are very close together, showing that within the limitations of the laboratory test the Kontol 120 and SP-8 had negligible effect on the corrosion rate. However, when the test strips are pretreated with a more concentrated solution of the two chemicals (about 1:1000 for 5 days), Curve 2 is obtained in tap water, showing a very low weight loss and fairly constant slope for about 12 days.

In Curve 4 the pretreated test strips are in the 1:75000 concentration of Kontol 120 and SP-8.

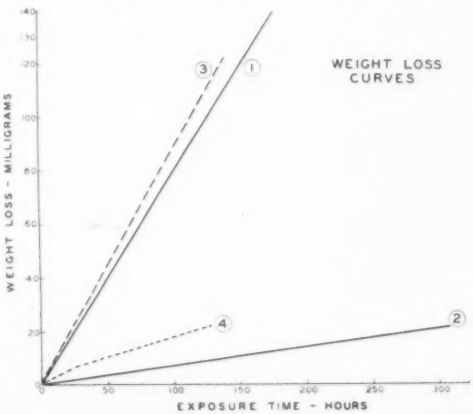
As aforementioned the principal problem in treating cooling-tower water is the prevention of heat-insulating scale and corrosion of the metal piping involved in a cooling-tower water system. A secondary requirement is the prevention of delignification of the wood cooling tower. It is believed that SP-8 and Kontol are also effective in controlling cooling-water delignification.

The proposed explanation of the behavior of SP-8 and Kontol in regard to wood delignification is as follows: The lignin portion of wood contains a multiplicity of carboxyl groups and these anionic groups would tend to react with SP-8 and form a surface molecule. They might also be expected to react to a considerable extent with Kontol compounds and in both cases would thereby yield a surface of hydrocarbon groups which would interfere with the attack of alkaline solutions on the lignin.[4]

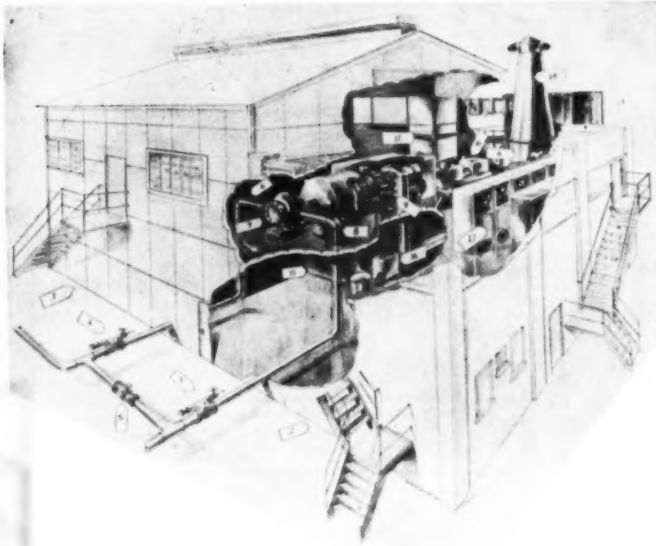
One of the primary reasons that this treatment is especially effective over and above the conventional treatments is indicated by the cost data below: For instance, Plant A, using conventional chemical treatment:

Chemical and amount—	Cost
Hexametaphosphate, 16⅔ lb. per day	$2.66
Sodium chromate, 8 lb. per day	1.20
Sulphuric acid, 66⅔ lb. per day	1.00
Chlorine gas, 18 lb. per day per week	0.25
Total cost, day	$5.11

(Continued on page 263)



Weight loss curves for soft iron in (1) aerated tap water, (2) aerated tap water after pre-treatment, (3) in dilute Kontol, SP-8 solution, and (4) in concentrated Kontol, SP-8 solution.



TURBINE-DRIVEN compressor installation, showing:

(1) Turbine building, (2) control room, (3) unit suction valve, (4) unit discharge valve, (5) bypass check valve, (6) gas compressor outlet, (7) gas compressor, (8) gas compressor inlet, (9) gas turbine, (10) starting turbine, (11) regenerator, (12) air intake, (13) air washer, (14) stack, (15) exhaust duct, (16) nozzle cooling tank, (17) duplex turbine controls.

Gas-Turbine-Driven Compressors Possess High Flexibility

El Paso Natural will install 28 units in intermediate booster stations between main-line reciprocating stations

by J. F. Eichelmann*

EL PASO NATURAL GAS CO. has purchased 28 gas-turbine-driven centrifugal compressors to be installed in intermediate booster stations between its existing main-line reciprocating stations. Basic ideas followed in application of the gas turbine are that better performance and more economical results are visualized for this gas turbine-driven centrifugal booster station.

There are several rather basic characteristics inherent in the design of these stations and in the application of the centrifugal booster stations which we have encountered and which should be of interest to the industry.

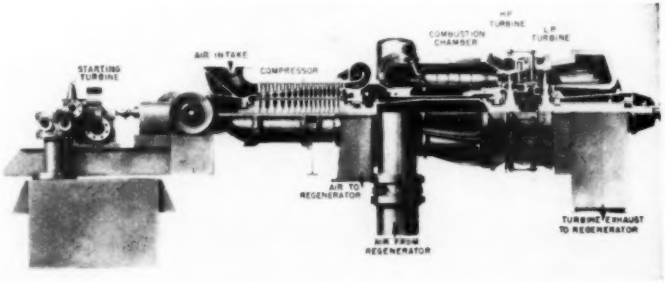
For a better understanding of our thinking on the gas-turbine application, the general design characteristics prevalent on our pipe line should be summarized.

Our southern line is equipped with six reciprocating main-line compressor stations, operating on a parallel system consisting of 26 and 30 in. pine lines approximately 737 miles in length. These main-line stations have been operating at compression ratios of approximately 1.5 with an average of 20,000 hp. installed in each main line compressor station. It was this system we proposed to increase in capacity a total of 300 million cubic feet per day.

We had to design for this increased volume in two phases. First, expansion requires an increase in sales capacity of 100 million cubic feet per day to the system, to be dropped off in West Texas, New Mexico, and a large portion in Arizona. In this case, a total of 900 million cubic feet per day was passed through the Guadalupe compressor station, as compared to the 780 million cubic feet per day under the present design conditions. The second phase of this expansion will require an additional increase of 200 million cubic feet per day to sales, for delivery to California, wherein 1,120 million cubic feet per day will be discharged through the Guadalupe compressor station.

When increasing the capacity of any existing gas pipe-line system, generally three methods are considered—looping an existing system; increasing the horsepower in existing compressor stations; or the construction of intermediate compressor stations. The pipe-line route was, of course, well known to us. The possibility of having to install large quantities of steel in the ground and the high installation cost of looping presented quite an outlay of capital for the increased volume.

Also, in view of the national emergency and the position of the steel supply in our national economy, it was necessary that foremost in our thinking we should consider the maximum utilization of the present equipment on our line, and also the operation of the present pipe line steel



GAS TURBINE.—Cross-section of 3,500-kw. regenerative cycle type. (Courtesy, General Electric Co.)

*Chief engineer, El Paso Natural Gas Co., El Paso, Tex., presented at annual meeting, Natural Gasoline Association of America, Houston, Tex., April 30-May 2, 1952.

capacity already in the ground at maximum efficiency. Thus, from these facts alone, the main motives present themselves for a thorough investigation of increasing the capacity of our pipe line through the rearrangement of station spacings and the installation of more horsepower.

The fact that we have existing main-line compressor stations spaced at approximately 100-mile intervals, caused considerable reflection on the possibility of reducing the station spacing and operating these compressor stations on approximately 1.4 to 1.45 compression ratios.

As you will note, in Fig. 1, which shows the plotting of pipe line steel in tons per mile versus volume, there is shown a considerable increase in steel required when increasing the volume from approximately 800 million cubic feet per day to 1,100 million cubic feet per day. This plotting, likewise, shows as a straight line across the curve the effect of intermediate compression represented in tons of steel. It should be noted from this figure that 25 per cent less additional steel is required in the ground for the 100 million cubic feet per day increased sales condition, and approximately 50 per cent less additional steel for the total sales increase of 300 million cubic feet per day. This effect alone was sufficient to call for new methods or changes of old methods to increase the pipe line system, regardless of our past ideas.

Fig. 2 shows a plotting of cost in dollars per million cubic feet per mile as plotted in increased sales capacity for various methods of increasing our pipe-line system. Curve A shows additions to existing compressor stations; Curve B represents pipe-line loops to the existing 26 and 30-in. pipe line. Curve C shows the effect of one intermediate compressor station, with Curve D showing the effect of two intermediate compressor stations. From this figure one can very well see the effect of the economics of the matter in arriving at our decision. Then, the problem resolves itself mainly into use of intermediate compressor stations, and no other method.

Since it has been shown that it was not possible at the time to use increased steel, it was then necessary to decide on the type of compression to be installed in these intermediate booster stations. From the comparison of the brake horsepower per million curves for the centrifugal compressor and the reciprocating compressor, it was readily apparent that the centrifugal compressor was the only type of compression to be installed. For example, at a 1.25 compression ratio, we would have to install 18,000 reciprocating compressor horsepower to do the same compression as that obtained in one 15,000 hp. centrifugal booster station.

Our next problem was, of course, the selection of the prime mover for the centrifugal booster stations. The geographical location of these plants was necessarily in the desert country where there is very little water for cooling and a high ambient temperature is experienced during the daytime. This ruled out the possibility of using a steam turbine driving the centrifugal compressors.

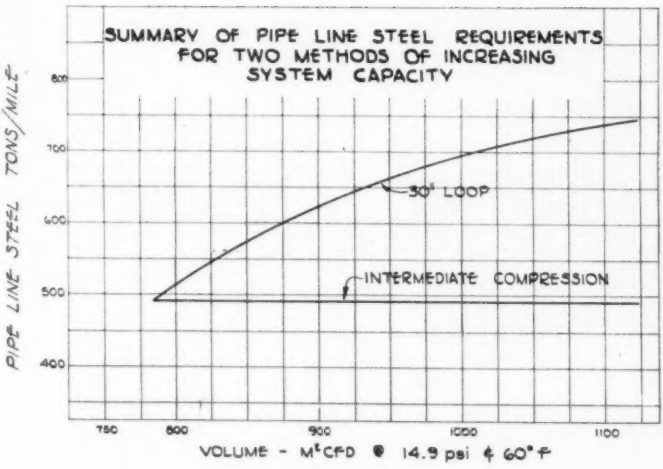


Fig. 1.

Our next consideration was the possibility of using electric power. There, again, in our part of the country there are very few power lines where large amounts of power could be readily available to our pipe line. Likewise, we thought that a variable-speed driver was required to enable the centrifugal compressor to follow more nearly the pipe-line flow characteristics. Of course with all of these factors influencing the final selection of a prime mower, it became evident that if there was a possibility of using the gas-turbine-driven centrifugal compressor, our problems could be solved.

Serious consideration was given to the reciprocating engine drive for the centrifugals, since the engines considered had the advantage of a much lower fuel consumption, and the performance characteristics of the centrifugal compressor in this case compare with those of the gas-turbine and steam-driven centrifugals. However, in the economic study of this plant arrangement, the reciprocating engine could not overcome the increased manpower and higher operating costs necessary for reciprocating equipment. This can be a serious problem in any large installation of horsepower. In our particular case

(Continued on page 264)

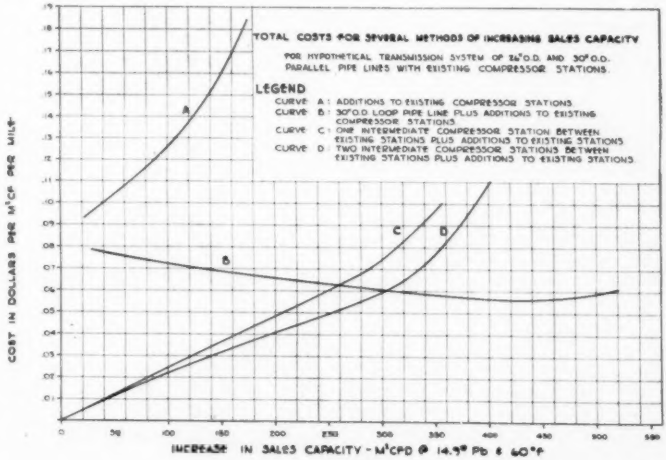
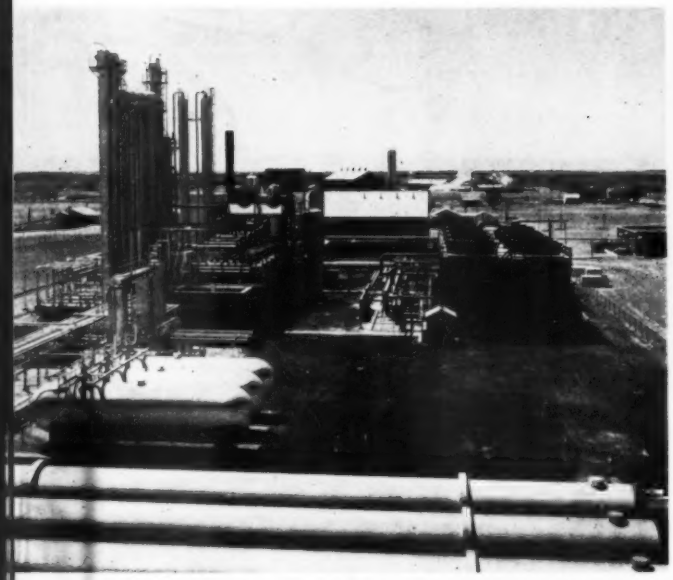

TOTAL COSTS FOR SEVERAL METHODS OF INCREASING SALES CAPACITY
FOR HYPOTHETICAL TRANSMISSION SYSTEM OF 26"O.D. AND 30"O.D. PARALLEL PIPE LINES WITH EXISTING COMPRESSOR STATIONS.
LEGEND
CURVE A: ADDITIONS TO EXISTING COMPRESSOR STATIONS.
CURVE B: 30"O.D. LOOP PIPE LINE PLUS ADDITIONS TO EXISTING COMPRESSOR STATIONS.
CURVE C: ONE INTERMEDIATE COMPRESSOR STATION BETWEEN EXISTING STATIONS PLUS ADDITIONS TO EXISTING STATIONS
CURVE D: TWO INTERMEDIATE COMPRESSOR STATIONS BETWEEN EXISTING STATIONS PLUS ADDITIONS TO EXISTING STATIONS
COST IN DOLLARS PER M¹CF PER MILE
A
B
C
D
INCREASE IN SALES CAPACITY - M¹CFD @ 14.9 PS & 60°F

Fig. 2.



View of Panoma Corp.'s natural gasoline plant at Hooker, Okla. Natural Gas Pipeline's booster station may be seen in background.

Fractionation equipment and distillation unit (rear) in Panoma's Hooker plant.

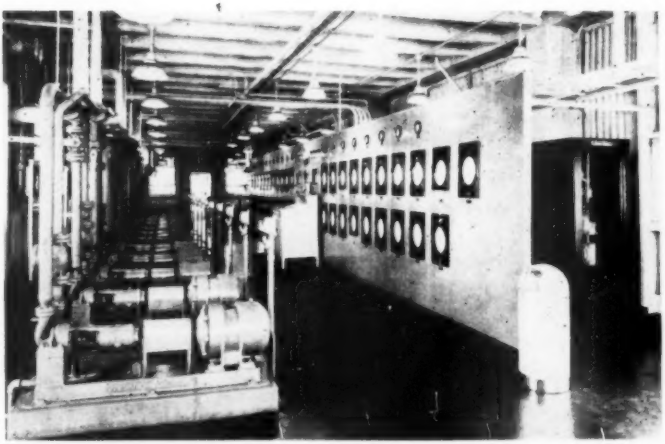
What's Happening in Fractionation?

. . . Here's an example of modern practice, in a plant processing gas from 120 dry-gas wells in Oklahoma Panhandle

by I. Earl Nutter*

IN the early twenties a truly revolutionary gadget called a stabilizer was introduced to the natural-gasoline industry. The stabilizer consisted of a vertical tower some 30 ft. tall filled with suitable packing such as steel shavings or ceramic tile, with the base connected to a horizontal reboiler tank very similar to the present-day arrangement of a reboiler and a bubble tower. The partially condensed still vapors were received in a make tank at about 20 psig. pressure with condensate from the make tank pumped to the middle of the packed stabilizer and vapors from the make tank going to a two-stage recompressor. The tower was refluxed only by expansion of recompressor condensates with condensate from the first stage pumped to a point one-fourth the distance down from the top of the stabilizer and second-stage con-

*Panoma Corp., Amarillo, Tex. Paper presented at annual meeting, N.G.A.A., Houston, April 30-May 2



View of control room. The pumping equipment serves the plant's fractionator.

densate introduced near the top in the packing. This latter point was located so that some of the packing above would serve as a mist extractor.

Pressure and temperature on the reboiler were controlled by air-actuated instruments of early design which required frequent adjustments to compensate for load, composition, and atmospheric variations. The products though stabilized to a definite Engler distillation and vapor pressure specification must have contained varying proportions of propane and butanes but at least no appreciable quantity of pentanes and heaviers escaped. The effectiveness of stabilization was gaged to some degree by the volume of product made. It was not uncommon for the top of the stabilizer to freeze solid with hydrates.

About 1926-27 fractionators of the basic design currently used were installed by a number of operators. At this same time the manufacture of liquefied petroleum gas and the marketing thereof in large quantities was inaugurated. These early fractionators had many gross shortcomings for the service in which they were employed but by any standard they were a remarkable advance over the old stabilizer just described. Tray designs were poor, tray spacings were generally too close, reflux requirements were unknown, control equipment lacked desired precision, and many other items gave frequent trouble and required constant attention. Since that time technique and equipment have constantly been improved and currently no operator would dare venture into the natural-gasoline industry without the use of fractionation equipment.

An example of modern practice in fractionation can well be disclosed through the description of Panoma Corp.'s plant located in almost the geographic center of the Oklahoma Panhandle. This plant processes gas from 120 dry-gas wells, each of which is on a full section (640 acres) lease. Panoma Corp. gathers the gas under natural pressure and delivers it to the gas purchaser at the purchaser's booster station adjacent to the plant. The gas is presently received by the purchaser at about 275 psig. and boosted to 680 psig. then delivered to Panoma's plant where it is processed and returned to the custody of purchaser beyond a block valve in the same line from which it was received for processing. Sale of gas to purchaser occurs about 1,000 ft. beyond this point at purchaser's metering station.

Panoma's contract with purchaser provides in part (1) purchaser shall boost the gas pressure sufficient to enter purchaser's main gas pipe line some 30 miles distant before delivery to Panoma for processing; (2) price of the gas shall be based on a 965 B.t.u. dry determination with the price increased or decreased proportionate to 965 B.t.u. but below 960 B.t.u. the price shall be further reduced 10 per cent; (3) Panoma shall operate a dehydration plant and reduce the gas to a maximum dew point of 25° F., and (4) purchaser shall boost all gas used for fuel and lost by extraction shrinkage without compensation. A later tentative agreement permits Panoma to process the fuel used by purchaser with purchaser being supplied from the main residue gas header leaving the plant.

In view of these desirable conditions, briefly related, and the relative permanency of a plant based on estimated gas reserves, the entire plant was designed for a minimum of

TABLE 1—NATURAL-GAS AND FRACTIONATOR FEED QUALITY

	Design analysis and yield at 14.65		Fractionator charge stock	
Components	Mol. pct.	G.p.m. at 14.65	Mols/hr.	Gal./hr.
Carbon dioxide	0.20			
Nitrogen	12.25			
Methane	74.91			
Ethane	6.57		2.0	19
Propane	3.88	0.4237	145.0	1,511
Isobutane	0.39	0.1196	49.0	607
Normal butane	1.10	0.3376	151.0	1,800
Isopentane	0.18	0.0708	28.0	389
Normal pentane	0.20	0.0720	31.0	426
Hexanes plus	0.32	0.1304	49.8	833
Total	100.00	1.1641	455.8	5,585

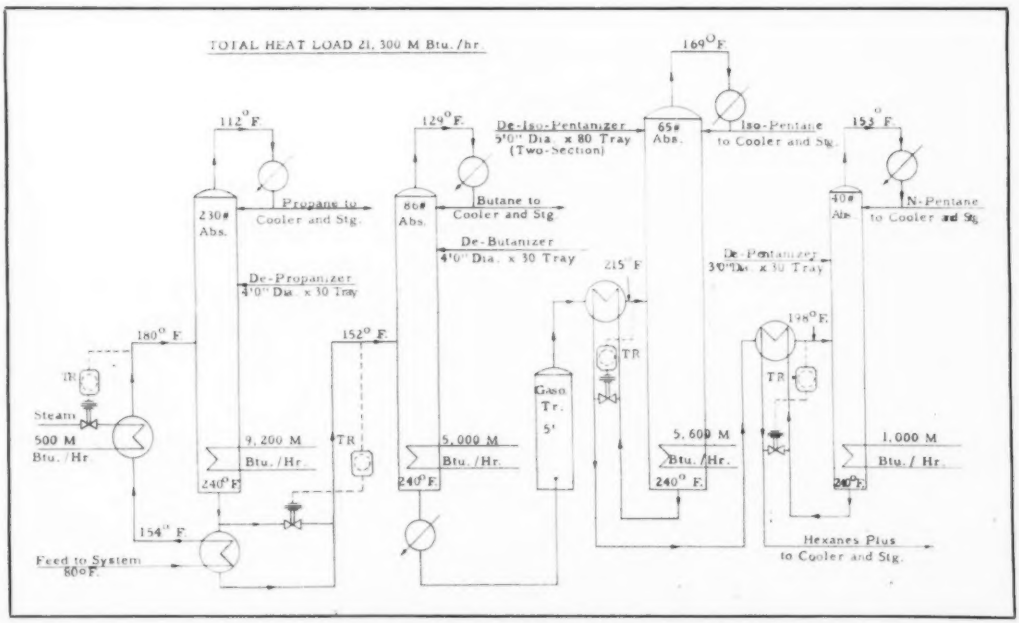


Fig. 1 — Flow arrangement for fractionation by consecutive topping.

maintenance, operating labor needs, fuel consumption, and maximum flexibility in marketing possibilities of products produced. Table 1 is an early evaluation of the analysis of the gas entering the plant and the charge stock to the fractionation system expressed in mols and gallons per hour.

The volume of charge stock to the fractionators used for design, is that obtainable from processing 100,000,000 cu. ft. daily at 14.65-psig. measurement of the analysis shown plus the recovery of 26-lb. R.v.p. product only from an additional volume of 40,000,000 cu. ft. of higher nitrogen content and with the reduction of the aggregate volume of 140,000,000 cu. ft. to 965 B.t.u. The composition of the charge to the fractionators results from employment of a rich-oil deethanizer in the distillation system. Vapors from the rich-oil deethanizer are passed through a reabsorber in the lean-oil stream to the main absorber to support the B.t.u. of the residue gas and permit maximum recovery of products for a given B.t.u. value of the residue gas. Residue vapor from the reabsorber has a B.t.u. value of 1,015, contains about 10 per cent ethane and 0.3 per cent propane, and supplies 80 to 90 per cent of the entire plant fuel requirement.

The fractionation requirement is to produce relatively high-purity propane, butanes (iso and normal mixture), isopentane, normal pentane and hexanes plus. There was no particular desire to remove all of the normal pentane from the hexanes plus but in present operation while producing good-purity normal pentane it is possible to remove any portions of the normal pentane desired up to a purity of about 98 per cent hexanes plus.

A study of two sequences of fractionation to accomplish these separations of products was made. One method considered was to consecutively remove the products in the order of their volatility and the other method to first separate groups of products and finally separate binary mixtures. This latter method was found to be economically more advantageous in several respects. Fig. 1 represents the method of consecutively removing the products in the order of volatility.

In the method shown in Fig. 1, the

TABLE 2—TOWER SIZES AND HOURLY VOLUMES

	Depropanizer	Debutanizer	Dependanizer Iso	Dependanizer Normal
A. Sequence of topping in order of volatility (Fig. 1):				
Tower size, ft.	4	4	5	3
No. trays	30	30	80	30
Working pressure, psia.	230	86	65	40
Mols/hr. feed	455.8	308.8	107.1	79.8
Mols/hr. O. H. product	*146.0	*202.7	*26.3	*30.7
Mols/hr. base product	308.8	107.1	79.8	*50.1
Mols/hr. reflux	889.3	437.8	641.7	67.5
Reflux/overhead	6.09/1	2.16/1	24.40/1	2.20/1
Reflux/base	2.88/1	4.09/1	8.04/1	1.35/1
B. Sequence of intermediate and binary operation (Fig. 2):				
Tower size, ft.	$3^1/_2$	$5^1/_2$	4	3
No. trays	35	35	80	35
Working pressure, psia.	250	120	30	25
Mols/hr. feed	348.7	455.8	57	107.1
Mols/hr. O. H. product	*146.0	348.7	*26.3	57
Mols/hr. base product	*202.7	107.1	*30.7	*50.1
Mols/hr. reflux	419.0	592.0	233.0	82.0
Reflux/overhead	2.87/1	1.70/1	8.47/1	1.44/1
Reflux/base	2.07/1	5.53/1	7.26/1	1.64/1

*Represent finished product.

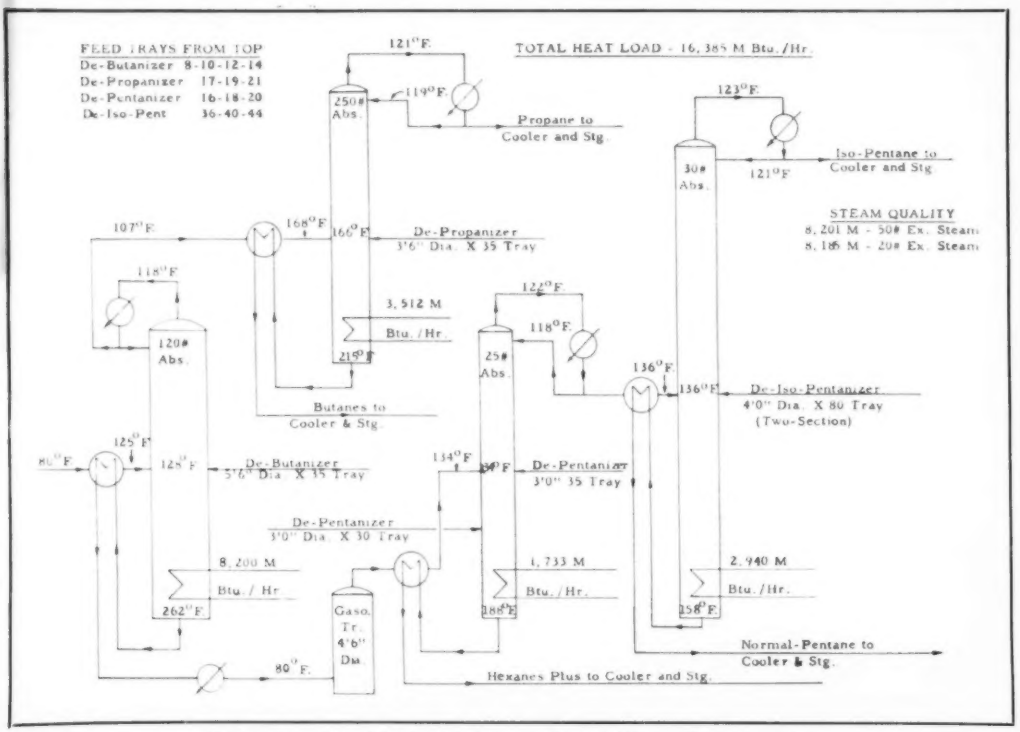
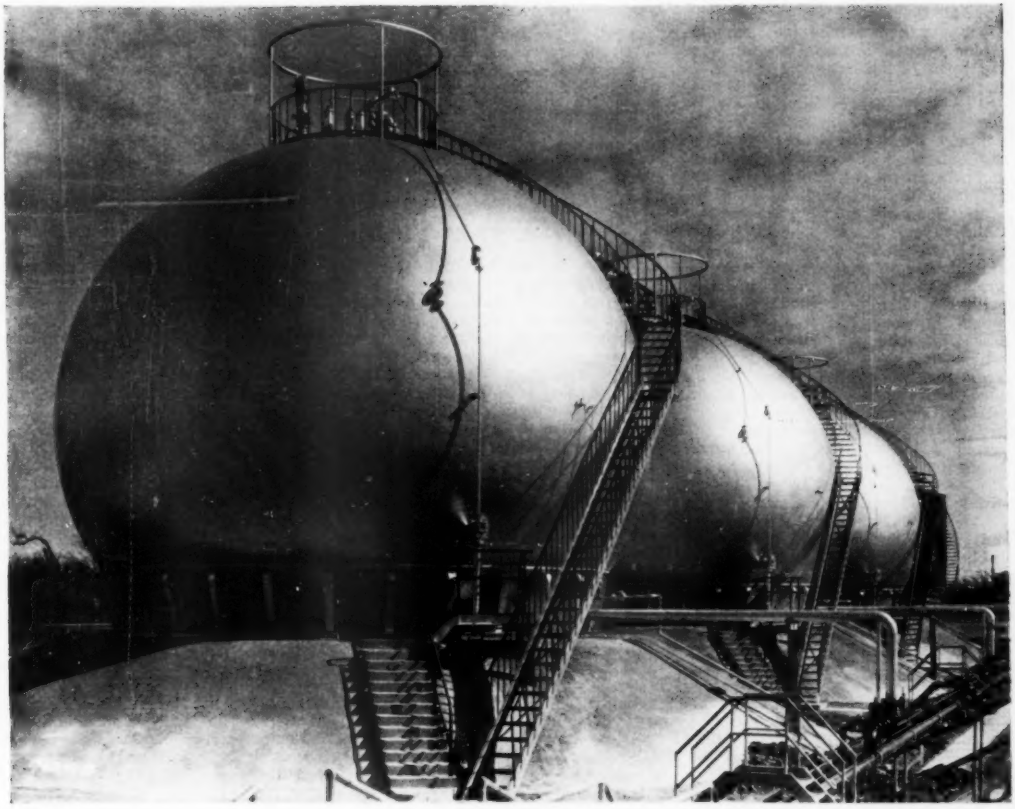


Fig. 2—Processing hookup for fractionation by intermediate separation.



Storing Distillate at Texas Gasoline Plant

The three 6,000-bbl. Hortonspheroids shown above provide less costly . . . much safer storage facilities for distillate at Shell Oil Company's gasoline plant at Provident City, Texas. Hortonspheroids provide less costly storage because they prevent practically all standing storage evaporation losses . . . and safer because they do not vent as much vapor to the atmosphere as tanks operating at only a few ounces above atmospheric pressure.

Hortonspheroids are built in capacities ranging from 2,000 to 120,000 bbls. with working pressures from 2½ to 100 lbs. per sq. in. Higher pressures are available only in the smaller capacities.

Shell's Provident City Plant

Shell Oil Company's gasoline plant at Provident City, Texas, has a capacity of 60 m.c.f. of gas per day. Approximately 50 m.c.f. of residue gas is dehydrated and sold to Texas Eastern Transmission Corp. Approximately 2500 bbls. of liquid products—propane, natural gasoline, and distillate are recovered from the wet gas by means of high pressure absorption. The natural gasoline and distillate are transported by pipe line to Shell's Houston refinery, and the propane to railroad tank car loading facilities at Sheridan.

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Boston, 10.....1025—201 Devonshire St.
Chicago, 4.....2128 McCormick Bldg.
Cleveland, 15.....2204 Guildhall Bldg.
Detroit, 26.....1514 Lafayette Bldg.
Havana.....402 Abreu Bldg.
Houston, 2.....2119 C & I Life Bldg.
Los Angeles, 17.....1523 General Petroleum Bldg.
New York, 6.....3347—165 Broadway Bldg.
Philadelphia, 3.....1615-1700 Walnut Street Bldg.
San Francisco, 4.....1544—200 Bush St.
Seattle, 1.....1325 Henry Bldg.
Tulsa, 3.....1606 Hunt Bldg.
Washington 6, D. C.....1139 Cafritz Bldg.

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over-all heating load of 21,300,000 B.t.u. per hour which was required would also require a cooling load for the reflux condensers of a reasonable approach to the same amount. The reboiler temperatures of two of the heavy-duty units had to be in the range of 240° F. in order to result in sufficiently high enough overhead temperature to effectively condense reflux with the available cooling-water temperature. The other two units though represented differently could have been operated at lower reboiler temperatures, where lower-grade exhaust steam could be used, with satisfactory overhead temperatures. However, had this been done, less utilization of heat exchangers, which was already poor, could have been realized and the result would have been the use of additional quantities of steam.

The sequence of fractionation selected is shown in Fig. 2. Though three of the units have been increased to 35 tray towers over 30 trays in the other sequence, the heat load required is 16,385,000 B.t.u. per hour, and is only 77 per cent of the heat load used in the other sequence of operation. Good utilization of heat exchangers is realized because, in the system as a whole, the volumes of base stocks are in better proportion to the feed stocks and the heat exchangers are smaller because the volumes handled are less.

About half of the steam required for reboilers is 50 psi. exhaust and the remainder is 20-psi. exhaust thus permitting better water rates on steam-operated mechanical-drive turbines used in other areas of the plant. Overhead vapor temperatures are all satisfactory for good condensing conditions yet sufficiently low to prevent any troublesome fouling with scale from the cooling water. A comparison of some of the tower specifications and volumes of streams of these two sequences of fractionation, for the charge stock shown in Table 1, and products to be produced are shown in Table 2. The total mols of reflux in the topping sequence is 2,036 per hour as compared to 1,326 in the latter. This is a reduction of 710 or 34.8 per cent in the mols reflux over the requirement in the topping sequence. The total volume of the towers in the tray sections is 5,074 cu. ft. in the topping sequence as compared to 4,842 in the latter. This is about a 5 per cent reduction.

The desired composition of products to be produced under design conditions are shown in Table 3. Here the purities of propane, butanes, and hexanes plus are about 98 per cent. Iso and normal pentane are about 95 per cent. Actually the 40,000,000 cu. ft. of gas daily, from which only a 26-lb. product was to be extracted, was not obtained for processing. However, a volume of 26-lb. natural gasoline equivalent to this volume of production is being purchased and with the plant processing the 100,000,000 cu. ft. daily, a volume of feed stock equivalent to design volume is being fractionated and iso and normal pentane in the order of 98 per cent purity is produced.

TABLE 3—COMPOSITION OF PRODUCTS PRODUCED

	Propane		Butanes		Isopentane		n-Pentane		Hexanes plus	
Components (%)—	Mol.	Liq. V.	Mol.	Liq. V.	Mol.	Liq. V.	Mol.	Liq. V.	Mol.	Liq. V.
Ethane	1.37	1.25								
Propane	97.95	97.96	0.99	0.86						
Isobutane	0.68	0.79	23.68	24.38						
Normal butane			74.34	83.72	1.14	0.82				
Isopentane			0.99	1.14	95.06	95.33	3.26	3.31		
Normal pentane					3.80	3.85	94.46	94.09	2.00	1.67
Hexanes plus							2.28	2.60	98.00	98.33
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Product purity	97.95	97.96	98.02	98.10	95.06	95.33	94.46	94.09	98.00	98.33

During winter months, when propane is in much greater demand than butanes, propane in the order of 0.60 to 0.65 gal. per thousand cubic feet of gas of better than 98 per cent purity has been consistently produced, with a portion of the butanes returned to the gas in the lean-oil stream to the absorbers to support a minimum of 960 B.t.u. on the residue gas. This recovery of propane compares with about a 0.42 yield in Table 1. Thus, the system is capable of more than meeting design product purity specifications at design load conditions.

Pentane Splitter

A detail of the pentane splitter is shown in Fig. 3. The schematic arrangement and instrumentation of the other three fractionation systems are the same as for this system. Feed from the discharge of the depentanizer reflux pump metered by a rate-of-flow controller reset by the liquid-level controller on the depentanizer reflux accumulator is introduced at one of three alternate entries approximately halfway between No. 1 and No. 80 trays. Overhead vapors pass under system pressure through a reflux and overhead product condenser to an accumulator. The system pressure is controlled from the base of the fractionation tower by a recording pressure controller regulating the flow of cooling water from this reflux and overhead product condenser. The condenser is mounted immediately over the accumulator with both mounted on steel supports on top of the roof of a steel-reinforced-concrete control and pump room.

The reflux and overhead product pump is located directly under the accumulator, thus about a 12-ft. suction head is provided from the base of the accumulator. The flows of reflux and of overhead product are regulated by rate-of-flow controllers operating on the discharge of the pump. The reflux controller is manually set and the overhead-product controller is automatically reset by a level controller on the accumulator. The level controller operates the full range of level in the accumulator and transmits the level to the overhead-prod-

(Continued on page 266)

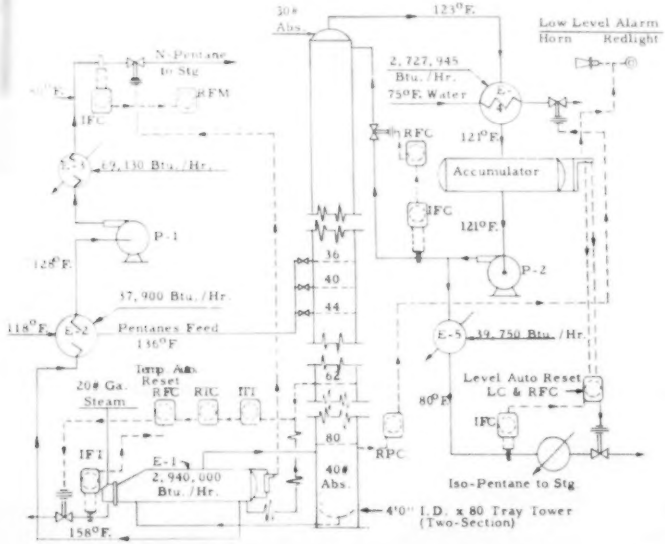

Fig. 3—Flow scheme for fractionation of pentanes.

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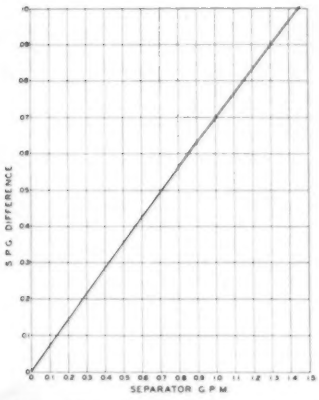

Fig. 1—Wet gas gravity as function of condensate content.

Producing and Gathering High-Pressure Gas

While this discussion covers both producing and gathering of high-pressure gas, it is confined principally to gathering systems. Different companies have different ideas on their approach to certain problems and probably in the same company there will be many differences of thought on the proper method of installing and operating certain equipment. This paper treats the later equipment and methods with which the author is familiar and to those which are believed to be improvements over some of the previous methods.

by Roy A. Schuster*

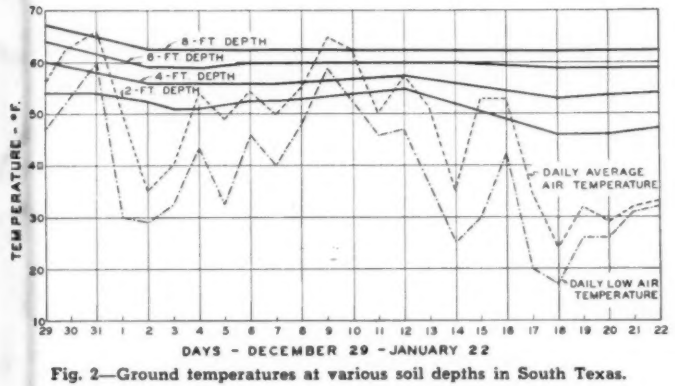

Fig. 2—Ground temperatures at various soil depths in South Texas.

ONE of the first problems in laying out a field gathering system is the sizing and location of the lines. Actual location of lines depends on location of the wells with respect to the plant and the type of terrain to be crossed. It is often advisable to lay several main field lines radiating outward from the plant, and connect the individual wells to these main lines with laterals.

In other cases, the field has been looped with one large main line which originated and terminated at the plant, with the wells being connected to the main line with laterals. One of the principal considerations in laying out a field system is to accomplish a good job with a minimum of investment. The determination of the minimum cost can be approached by designing several systems, and choosing the one with the lowest cost which is adequate for the job.

The method of determination of the size of the pipe is open to considerable discussion. None of the several pipe-line-flow formulas will accurately apply to a gathering line containing both gas and liquid. Liquids accumulate in the lower places in the line, requiring an increase in pressure to move the liquid over into the next low place, resulting in actual pressure drop being larger than that calculated. Experience has shown that with main lines, approximately 6 in. in diameter in short lengths of 2 or 3 miles and with the gas containing about 1 gal. per M.c.f., the pressure drop can only be approximated by using one of the standard pipe-line-flow formulas and then multiply by 1.5 per cent.

Testing

When a well is connected into the main system, some method of testing the gallons per thousand cubic feet of the gas must usually be provided for at the well. Several methods may be used to make these tests. In some instances a field separator is set on the line at the well and the tests run on this separator. In some cases the separator is calibrated and the test, which can be run periodically, is

*Manager of plants The Chicago Corp. Presented at N.G.A.A. convention, Houston, May 1, 1952.

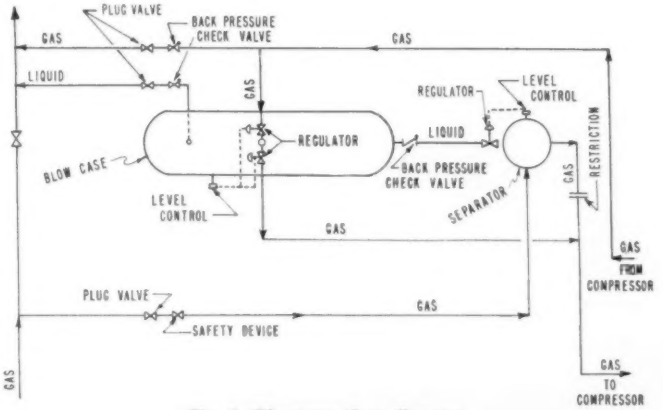

Fig. 3—Blow-case flow diagram.

made by shutting in the liquid dump valve on the separator, measuring the volume of distillate produced in the separator over a period of time, and calculating the yield from the volume of gas passed through the separator. In other cases the liquid can be measured continuously by the use of meters. By taking a slight pressure drop across the separator, the liquid can be forced continually through the meter and into the gas line downstream from the control equipment. The cost of installing a separator on a well is considerable, and depending upon the number of wells in the field, a very large amount of money can be invested in the installation of a large number of separators.

Due to the large investment required for the installation of separators, Chicago Corp. engineers have relied on the use of a gallon per thousand test wagon to make periodic tests of the yields on each individual well. In the actual installation of equipment to sample the stream at the well, the gas first passes through an orifice meter, then through a test loop buried in the ground, and then through an adjustable choke. By maintaining well-head pressure on the meter run, it is believed that the liquid remains better in the gas phase, thus resulting in better measurement. Test loops are usually fabricated from 1-in. pipe and are of the proper length to meet N.G.A.A. specification for sampling. It might be mentioned here that the installation of the proper equipment and the operation of such equipment for sampling is of utmost importance. Undoutedly, more trouble has been experienced in the proper sampling of these two-phase streams than has been encountered in the actual running of the tests.

The method of running the tests consists of passing the sample gas stream through a small calibrated separator and measuring the liquid which drops out in the separator. The gas which leaves the separator is likewise measured. A sample of the liquid in this high-pressure small-scale separator is flashed to atmosphere to obtain the flash factor. This factor when applied against the yield as determined in the small high-pressure separator gives the actual yield which would have been encountered in stock-tank conditions. A charcoal test is usually run on the residue gas from the separator. This may or may not be included in the test yield, depending upon the processing agreement. The specific gravity of the gas is also run on the residue gas.

Sometime ago results of this test as compared to that obtained from full-scale separators was questioned. As a result of this discussion, meters were installed in one of the plants to measure total volume of condensate produced from the master separator in the plant yard through which all of the gas was processed. In actual plant operation, the distillate was never flashed to atmosphere, but was processed through stills at a higher pressure. The meters were actually installed on the outlet of a 500-psi. condensate vent tank. Then a series of flash factors were obtained by actually running tests to determine the loss which would occur if this 500-psi. distillate were flashed to atmosphere. During a period of 2 years, about 1,500 flash tests were run. The average of this flash factor when applied against the volume of distillate, measured through these large meters, gives the volume in barrels produced for the month from all wells. A comparison of the results obtained from the meters with that of the test-wagon method shows the difference to be only a few per cent points.

Specific gravity as determined by the test wagon is run on the residue gas from the separator; whereas, that of the wet gas at the meter is required for accurate calculation of the gas volumes. Knowing the specific gravity of the dry gas, the specific gravity and molecular weight of the distillate, and the recovery of distillate in gallons per thousand cubic feet, the specific gravity of wet gas can be calculated. This calculation, however, is quite cumbersome and would require considerable time if applied to the specific gravity used to calculate gas volumes on each well.

It was thought that it would be desirable if a table or curve could be prepared which would quickly convert the above data from the dry to wet-gas specific gravity. A curve which has proved very practical and quite accurate for this purpose was prepared. (See Fig. 1.) Various points on this curve were determined by assuming a dry-gas gravity which was the average of the gravity in this particular field. From this dry-gas gravity, the wet-gas gravity was calculated for different gallons per thousands. By subtracting the dry-gas gravity from the corresponding calculated wet gas gravity, a difference is obtained. The curve was prepared by plotting these differences against the gallons per thousands. To use the curve, the actual gallons per thousand as tested on the well is located on the curve to find the proper difference. This difference is then added to the actual dry-gas gravity as tested to obtain the wet-gas gravity. The accuracy of this curve has been checked for various dry-gas gravities, molecular weights, and gravities of distillate, and over the normal range of operation, the maximum error has been found to be 0.0005. For practical purposes, this error can be disregarded. This curve has been of considerable help to the meter department in the calculation of gas volumes.

In connecting wells to the field lateral lines, practice has been to set the lines in concrete just as they enter the ground downstream from the choke. On one occasion, this line ran straight from the well approximately 4,000 ft. to the main line. When this well was turned on, expansion of the line, due to high temperature of the gas, broke the concrete block and almost bent together the test loop. Had this field line been connected directly to the well without the test loops, the well connections would have undoubtedly been broken. It is now the practice to come off of the well head connections at an angle of approximately 90° to the field lines, which permits the bend of the pipe in the ground to take up most of the expansion.

Location of expansion loops for gathering lines has been open to considerable discussion. On several occasions an attempt was made to calculate expansion and properly locate these bends. When the lines were installed and placed in operation, instead of the loops taking the expansion, the lines came out of the ground in some other location. Apparently, the compactness of the soil, slight bends in the pipe, etc., had more to do with the control of the point at which expansion was relieved than had the actual location of the loops. In recent Chicago Corp. installations, loops have not been installed. Care must be taken, however, that the lines are very securely anchored at critical locations such as the well head, headers, etc., to prevent this equipment being damaged. Then when the line is placed in operation it is watched closely, and if the line comes out of the ground at any place, the expansion loop is installed at that location.

Corrosion

Chicago Corp. operations have been almost entirely in sweet-gas fields, and, consequently, little experience has been gained in corrosion. However, some corrosion has been experienced in a few wells due principally to CO_2 or some of the organic acids. Considerable experimenting was done with various compounds, and finally, one of the common corrosion inhibitors on the market was found to reduce the trouble. The inhibitor is admitted to the well at certain intervals, depending upon the gas volume produced and the amount of corrosion incurred. If the liquid-type inhibitor is used, it is injected either with a lubricator or a small pump. Corrosion has been greatly reduced, and, consequently, this method of solving the particular corrosion problem has been satisfactory.

In Chicago Corp. main lines, very little internal corrosion has been noticed. All of the field lines are protected externally with cathodic protection. Depending upon the location of the field lines with respect to the plant, the rectifiers or generators are installed either in the plant, in the field, or in both. Wells are electrically

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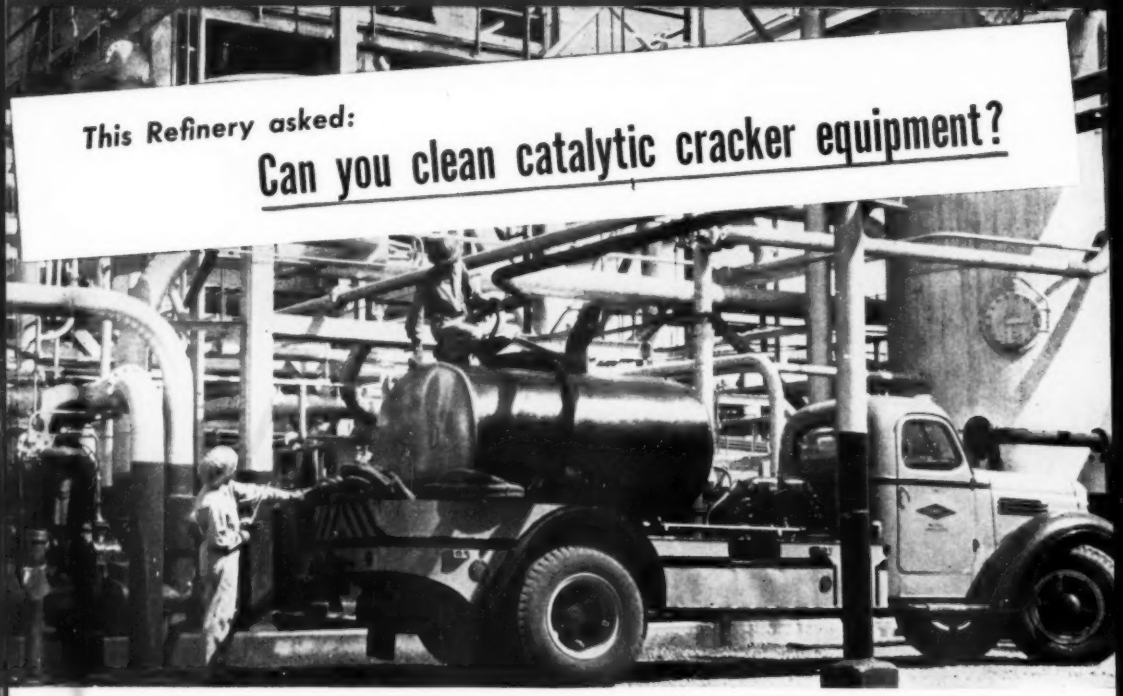

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On another catalytic cracker, the increased through-put resulting from Dowell Service had an estimated value of $4,300 per day.

All types of equipment on catalytic crackers have been cleaned effectively by Dowell Service methods . . . *without dismantling and with a minimum of down-time.* Dowell furnishes trained personnel and all necessary equipment. Dowell engineers apply liquid solvents according to the technique demanded by the job: for example, by filling, spraying, jetting, cascading or vaporizing. These solvents are designed to remove deposits quickly, efficiently and economically. Often equipment may be cleaned while it is in operation.

Call Dowell for assistance on your maintenance cleaning problems. Dowell Service is applicable to condensers, process towers, pipe lines, storage tanks, boilers, cooling jackets and other refinery equipment. Experienced Dowell engineers will be glad to consult with you. No obligation, of course. Phone the nearest Dowell office today.

Other recent Dowell jobs:

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Three waste heat boilers were Dowell cleaned. Following this fast, efficient service, these boilers produced 23% more steam per hour with an estimated $49 per day payout to refinery.

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★ *Chemical services for oil, gas and water wells.*

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insulated from the lateral lines to prevent drainage of current. A complete check is usually made of the plants and the fields at least once a year to determine whether the proper protection is being maintained throughout the system. Usually, only minor adjustments are required in the units or in the ground beds. Occasionally a new unit is found to be required after making some major changes in the field or plant piping.

Hydrates

Normally, when starting up a new field system, considerable trouble is experienced due to hydrate formation which plugs off the lines. In the areas in which Chicago Corp. operates, hydrate formation at pressures around 1,200 or 1,400 psi. have been found to occur at approximately 58° or 60° F. These hydrates can be removed by bleeding the lines down to atmosphere and blowing out the liquid. After a few days of operation, and when the field lines are only a few miles in length, sufficient heat is usually carried in with the gas from the wells to keep the temperature above hydrate formation. In longer lines where the temperature drops below the hydrate point before the gas enters the plant, it is usually found advisable to install heaters on the line.

It has been noted that hydrate trouble is experienced more often in cold weather, indicating that atmospheric temperature has considerable effect on the temperature in field lines which are buried to a depth of 2 to 3 ft. The question arose as to temperature of the ground at a greater depth, the thought being that the temperature at a greater depth might no drop below the hydrate point. Consequently, a test was run, taking temperatures at 2-ft. intervals from a depth of 2 ft. to a depth of 8 ft. During a cold spell while the test was being run, it was found that the temperature at a 2-ft. depth reached a low of 46° F., which is below the hydrate point. At a depth of 6 ft., the temperature did not fall below 59°, which is on the border line of hydrate formation. (See Fig. 2.)

It is believed that in long lines, say approximately 10 miles in length, the trouble due to hydrates could be greatly reduced if the line was placed at a depth of 6 ft. or more; this would be limited to a location where winter temperature is similar to that encountered in East Texas. It is estimated that the additional cost of laying 3 miles of pipe at the greater depth would be equal to the cost of a heater. This cost is the initial investment. All fuel cost and operating expense would be eliminated. Although there has been no occasion to install a great amount of pipe since these tests were run, plans call for installation of some pipe in the future at the greater depth, when the occasion arises, because it is believed that such an installation has considerable merit.

As the pressure declines in a field, the point will eventually be reached where compression will be required. If only one or two reservoirs are involved, and the pressure decline is uniform throughout the field, one compressor station could be centrally located, normally at the existing gasoline plant, and the entire field placed on compression at one time. Usually, however, the pressure will decline more rapidly in one section of the field than in the other section, and it is necessary to compress the gas from a few wells before compression of the entire field is required. Considering the location and number of weak wells, it may be expedient to install one of the small so-called portable compressors to compress the gas from one or two wells. We have found this to be desirable in several cases. By installing two or three units, the installation of the central compressor station, with large initial costs, carrying charges, and operation, has been postponed several years.

Blow Cases

When wet gas is compressed, liquids must be removed beforehand to prevent damage to the compressor unit. Liquid occurring after compression must be returned to the discharge of the portable compressor so that it may be processed by the gasoline plant. This liquid can either be returned to the compressor discharge line by some type of pump or by a blow case. Most of the portable units are situated in some isolated location, and the field operator makes daily rounds of two or three units. It was believed that trouble might be experienced in continuous operation of liquid pumps with no operator in attendance, and it was decided that a blow case would be more satisfactory. Since a blow case would be operated with regulators and liquid-level controls only, it was believed that less mechanical trouble would be experienced when operating with no one in attendance.

The actual blow-case operation consists of passing gas from the well through a regular field separator, through an orifice plate or other restriction to obtain a slight pressure drop, and then to the compressor. (See Fig. 3.) The gas from the compressor is pumped into the main line at the required higher pressure. The compressor unit is protected with high-level, temperature, and pressure automatic safety shut-down controllers.

In normal operation, the blow case floats on the suction line at the same pressure as the suction to the compressor downstream from the restriction point. When liquids have accumulated in the separator to the control point, the control opens to permit the liquid to be pressured into the blow case. When the liquids in the blow case rise to the control point, the regulator which connects the suction line of the compressor to the blow case closes, and the regulator connected to the discharge line opens, which pressures the blow case to discharge pressure, permitting the liquid to flow into the discharge line of the compressor. When the liquid drops to the control point, the regulators operate in the reverse fashion. A check valve is located between the separator and the blow case to prevent backflow of liquid if the control on the separator should open at the same time the blow case was being pressured. Several of these units have been in operation for 2 or 3 years and very little trouble has been experienced.

Compressors

As pressure declines on more wells, the point is reached where considerable horsepower is involved to compress the gas. Then consideration should be given to the installation of one large central compressor station. A study has recently been made for a particular case, comparing the cost of one large station to that of small compressors at each well. If one large central compressor station were installed, it would be necessary to loop the existing field lines to produce the same volume of gas at a lower pressure, due to the pressure drop increasing with the lower operating pressure; whereas, if small compressors were installed on each well, each compressor would discharge into the existing lines at the present high pressure and the looping of the field lines would be eliminated.

In actual practice, it is impossible to purchase a unit of the exact horsepower required for the particular volumes of gas and pressures to be encountered. Engines of the next larger size must be installed. As an example, to fulfill 215-hp. requirements, it might be necessary to install a 250-hp. unit. Considerable loss of horsepower results when 30 or 40 units are required. Also, the cost per horsepower-hour for the small units is higher than the large compressors. In the case recently studied, the cost of installing one large central compressor station and looping the field lines amounted to approximately 1½ million dollars, whereas the cost of installing a compressor on each well amounted to almost 2 million dollars. Small units require more operating labor, maintenance, and other expenses than one centrally located plant. It was estimated that the direct operating cost of the individual units would be almost twice that of one large central plant.

No hard-and-fast rule can be established to govern the economics of every situation. Every field, due to differences in topography, well spacing, accessibility, climatic conditions, etc., will present a separate problem.

(Continued on page 268)

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Training of Analysts

Minor errors in analyses of laboratory gas samples can result in thousands of dollars of excessive costs in commercial plant operation, this author declares.

by Joe F. Wood*

RESULTS of the N.G.A.A. fractional-analysis survey samples to date indicate a wide divergence in analyses on samples of known composition. Cause of this divergence points positively to the operator and supervisor, with lack of training being the major contributing factor.

When operators do not realize the significance of minor errors, and are not conscious of the multiplication factor used to expand an average laboratory gas sample to a 60,000-M.c.f. per day plant, then actual money leaks begin to develop, since such errors result in misdesigned plants. Analysts must be trained to avoid this supposedly "fact-founded" series of errors.

Henry Beeson, of Magnolia Petroleum Co., Dallas, at the N.G.A.A. Fort Worth seminar, covered some of the major analytical pitfalls in plant design and operation. Table 1, by Beeson, shows the extent of an error by expanding erroneous analytical data to 60,000 M.c.f. per day. The figures presented in this table are not fanciful, nor imaginary. They can happen in any laboratory.

TABLE 1

Construction cost*—	
Change from 10-in. vacuum to 10-psi. pressure:	
Gathering system	$72,000.00
Compressors	900,000.00
Operation*—	**$ per year†**
0.5 gal. per 1,000 cu. ft. error on propane content: Oil circulation	24,000.00
0.1 gal. per 1,000 cu. ft. error pentanes missed in residue	105,120.00
10 per cent isobutane in 26-lb. gasoline	18,000.00
0.5 Mol per cent error in pentane content of 80,000 gal. daily delivered gasoline	4,500.00

*60,000 M.c.f. daily. †From report by Henry Beeson, N.G.A.A. Seminar, Fort Worth, March 16, 1951.

Exactly to what degree an error is significant is shown in Table 2. Data in Table 2 are based on an error of misreading pressure on a standard 3-l. receiving flash by 1 mm. of mercury. A total error in actual gas volume of 3.48 ml. at 60° F. and atmospheric pressure (this datum based on a nominal 3-l. receiving bottle, and not actually 3,000 ml.).

Obviously the actual significance of the error is tied to the size of the sample and the product being fractionated overhead. This error is expanded into a 60,000-M.c.f.-daily natural-gasoline plant in Table 3.

Cumulatively, the 1-mm. error, recurring in the propane, butane, pentanes plus type of analysis (and then only once per fraction) amounts to $25,326.50 per year. On the propane, butane, isopentane, n-pentane, hexanes plus type analysis (still occurring only once per fraction), this seemingly insignificant error amounts to $59,692.64 per year. These estimates are based on the largest indicated sample (approximately a 5-gal. bottle of gas), thus actually represent a near-minimum error. You can afford to train your analysts. You can afford to keep them trained.

In answer to the problem of where and how are analysts to be trained, a laboratory-type training school has been proposed. Such training to be offered will be determined by needs of the industry as developed at the Fort Worth seminar and another similar seminar as yet to be held.

The primary object in offering a uniform training program for gas analysts to the industry, is to improve accuracy. As this goal is achieved, agreement among companies buying, selling, and trading natural gas, gasoline, and L.P.G. will improve with particular reference to composition of the products being handled. When laboratories of different companies can check each other, then costly and time-consuming duplicate sampling and analysis with ultimate resort to referee analysis will be eliminated.

The N.G.A.A. Fractional Analysis Samples 4 and 5 were completed early this spring and the average deviation from known composition was calculated. Attention is directed to the designation deviation from known composition, and not deviation from average analysis; there is a great difference. This average deviation from known composition varied from 0.14 to 9.26 mol per cent among the laboratories of the various participating companies. For the least deviation, this amounts to 0.00022 gal. per thousand cubic feet (pentanes-plus basis) but, the 9.26 mol per cent deviation (3.98 gal. per M.c.f.) is startling. A company would not frown on an error of 0.00022 gal. per M.c.f., but gasoline plants are built to process gas of considerably less than 3.98 gal. per 1,000.

These determinations were not made by novice analysts. They are all from trained analysts in commercial laboratories, where investments are being approved and refused on the basis of analytical results.

Proposed Training Program

The technical committee of N.G.A.A. is proposing a school, under associa-

TABLE 2—ERROR* IN GALLONS PER THOUSAND STANDARD CUBIC FEET

Sample, ml.	Propane	Isobutane	n-Butane	Pentanes	Hexanes
6,000	0.0162	0.0186	0.0182	0.0211	0.0300
8,000	0.0121	0.0140	0.0137	0.0159	0.0224
10,000	0.0097	0.0112	0.0109	0.0127	0.0179
12,000	0.0081	0.0093	0.0091	0.0106	0.0149
14,000	0.0069	0.0080	0.0078	0.0090	0.0128
16,000	0.0061	0.0070	0.0068	0.0079	0.0112
18,000	0.0054	0.0062	0.0061	0.0071	0.0099

*1 ml. mercury pressure in 3,000-ml. receiving bottle (nominal capacity).

TABLE 3—ERROR* IN GALLONS PER YEAR FOR 60,000 M.C.F. PER DAY

Sample, ml.	Propane	Isobutane	n-Butane	Pentanes	Hexanes
6,000	354,780	407,340	398,356	462,090	657,000
8,000	264,990	306,600	300,020	348,210	490,560
10,000	212,430	245,280	238,710	278,130	392,010
12,000	177,390	203,670	199,290	232,140	326,310
14,000	151,110	175,200	170,820	197,100	280,320
16,000	133,590	153,300	148,920	173,010	245,280
18,000	118,260	135,780	133,590	155,490	216,810

Value of Product Losses Through Error†

Operation A—	$ per year	Operation B—	$ per year
Propane—118,260 gal. at 3 cents	3,547.80	Propane—118,260 gal. at 3 cents	3,547.80
Butanes—185,645 gal. at 4 cents	7,425.80	Butanes—185,645 gal. at 4 cents	7,425.80
26-lb. gasoline‡—239,215 gal. at 6 cents	14,352.90	26-lb. gasoline§—811,984 gal. at 3 cents	48,719.04
Total	25,326.50	Total	59,692.64

*1 ml. mercury pressure in 3,000-ml. receiving bottle (nominal capacity). †Basis, 18,000-ml. sample. ‡Pentanes-plus basis. §Iso and n-pentane, hexanes plus basis.

*Superintendent, research and development, Skelly Oil Co. Presented at N.G.A.A. meeting, Houston, May 2, 1952.

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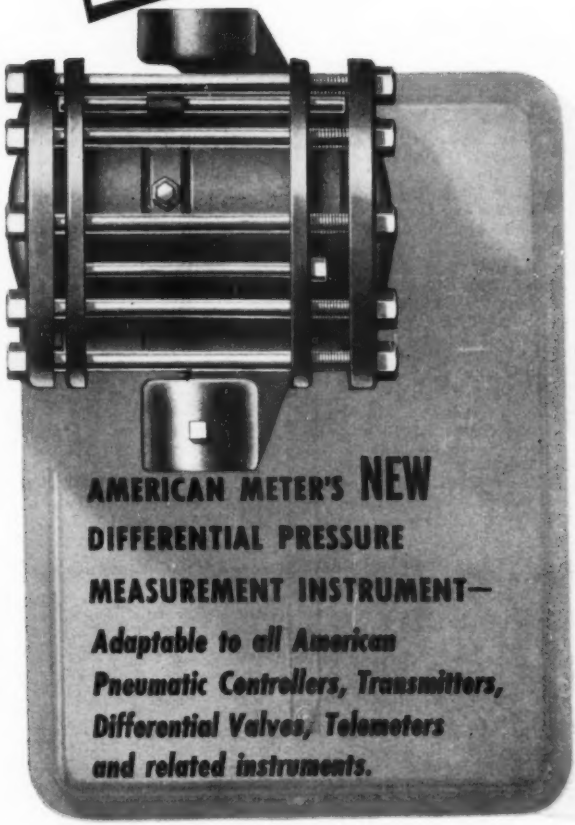

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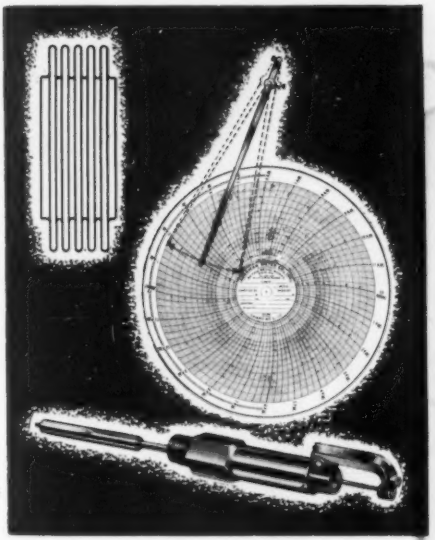

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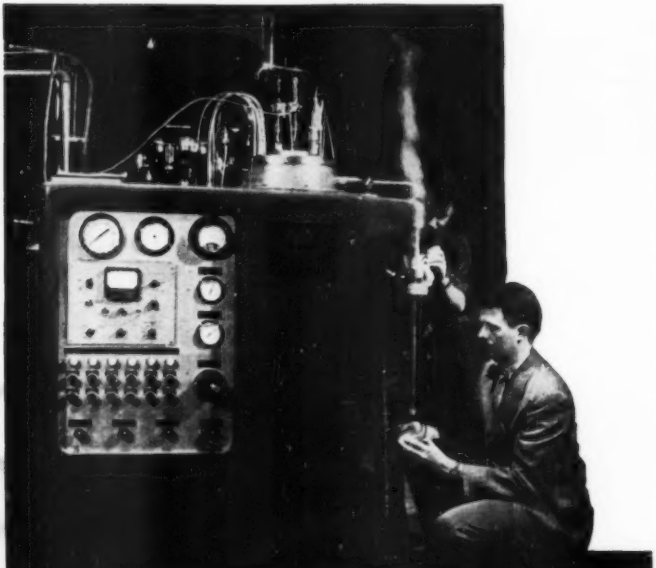

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tion sponsorship and supervision. This school is to be located at a mutually satisfactory university, with a full-time instructor to operate the school, conduct classes, and perform such experimental research and development on methods and equipment as time permits. The tentative plan for such a training course puts it on a tuition basis of $50 per week for a 3-week course. The course would be repeated monthly for a total of nine complete training periods in any single year of operation. Each class is to be limited to 10 students.

At the outset, the instruction will be approximately one-third theory and two-thirds operation. It is not the intention to develop a "cook book" procedure but to teach application of proper theory and methods as a means of developing more accurate analytical technique, by use of the actual equipment available to the analyst in his own laboratory. A few manufacturing companies have offered to furnish on a loan basis, the equipment needed for such training.

In general, but subject to revision as the plan is formulated, the phases to be covered in such a training school are:

1. Proper sampling techniques and procedures, both in field and in plant or laboratory.
2. Orsat analysis, combustion, absorption, etc.
3. Handling of samples within the laboratory.
4. Introduction of samples to the apparatus.
5. Treatment for removal of specific compounds such as sulfurs, water, etc.
6. Technique of actual distillation, to include size of sample, rates of distillation, reflux ratios, etc.
7. Auxiliary techniques such as refractionation of cut points, vapor pressure method of cut-point determination, etc.
8. Calculations.
9. Application and significance of results.
10. Theory of gas analysis.

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1. Standard Orsat-analysis equipment.
2. Low-temperature fractional analysis equipment.
   (a) Manual.
   (b) Semiautomatic.
   (c) Fully automatic.
3. Auxiliary equipment for special methods.

The course would tend to be repetitious over any selected unit of time; however, it is to be continually modernized as new equipment and methods are developed, and expanded to include other phases of gas analysis.

During the 3 months not scheduled for the school, the instructor is to visit his students in their own laboratories to observe the application of his teachings and to be available for special problems.

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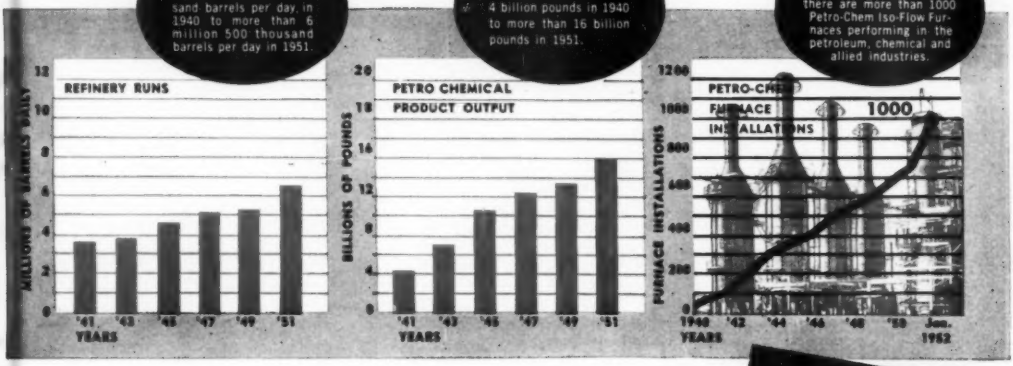

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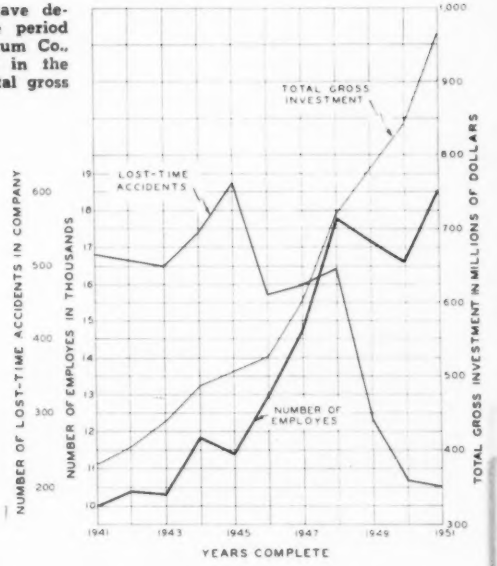
LOST-TIME ACCIDENTS have decreased significantly in the period 1941-1951 at Phillips Petroleum Co., in spite of large increases in the number of employes and total gross investment.



Engineering For Safety . . .

. . . in cycling and gasoline-plant operations

by G. M. McCullough*

BACK in the early days of the natural-gasoline business it would have been impossible to build a natural-gasoline plant had it not been possible to get a lot of 2-in. pipe. Since welding was in its infancy, we were required to thread all connections. It was very difficult to thread pipe larger than 8-in. on the job, and even this size gave us many problems with cast-iron fittings. Those were the days when we broke in our new roustabouts and roughnecks by sending them after a set of left-handed pipe tongs and pipe wrenches and sky hooks.

Modern Plants

The natural-gasoline business grew out of these so-called primitive ways of designing, construction, and operation of gasoline plants and have advanced to the present modern-day way of manufacturing natural gasoline and the various components derived from natural gas. We have developed rigid standards in this relatively short time where practically all piping from $1^1/_2$ in. up is welded and the fittings are made by use of flanges. Whether we recognized it or not this advancement provided a safer plant to work in as well as cutting down initial installment and maintenance costs.

Through research we have more or less eliminated the old practice of trial and error to make a new process work. Pilot plants are constructed to prove the new processes to determine if the proper fundamentals of design and research have been applied and to determine if it is economically sound to go to a new procedure before large sums of money are spent to build a unit of full plant capacity.

Metals used in these new processes have been tried, tested, and proved many times by our metallurgists before lines, vessels, pumps, valves and fittings, and heat-exchange equipment are fabricated from the various alloys. This information was also developed in pilot-plant operations, all of which materially aids in the reduction of personal injuries and equipment damage by explosions and fire. Our research work is continuing on development of new materials to stand temperatures, pressures, and chemicals used in these new processes.

Plant Layout

Plant layout and arrangement of equipment must be given serious consideration in the early stages of planning, as the expenditures involved would make it prohibitive to rearrange the equipment once installed. Gas or oil-fired boilers, furnaces, and preheaters should be located to take advantage of prevailing winds, so that they will not afford a ready source of ignition for escaping hydrocarbons. Internal-combustion engines should be given the same consideration.

Layout of process equipment should be such that in event of fire in one portion of the unit, the possibilities of the fire spreading to adjacent equipment will be minimized. This area should be laid out to provide avenues of exit for employes in the event of explosion or fire. Such an arrangement would also provide ease of operations for the operators and, with the same forethought and planning, ease in maintenance of the equipment by providing accessibility for replacement with crane or hoisting facility can and should be incorporated.

The removal and replacement of tube bundles, pumps, and motors from heavily congested process and operating areas is a continual invitation to personal injuries and equipment damage if the removal facility is not provided. Cooling towers, whether they be of the atmospheric or induced-draft type, should be located so the prevailing winds will carry the spray away from plant equipment and working areas. Proper location of cooling towers will reduce the amount of external corrosion and ultimately prolong the life of plant and equipment.

Plant Piping

Plant piping should be laid out so that periodic inspections can be made with ease to determine the rate of external and internal corrosion. A good piping layout will provide less down time when unsafe lines have to be replaced. At this point I would like to mention that if you do not have an inspection department to make these periodic inspections and keep permanent records of plant equipment, I feel that the plant or company safety engineer should be vested with this responsibility to see that the equipment is being inspected periodically and that necessary recommendations for replacement are made to management. The net result of a good equipment inspection, testing, and repair program will be the reduction in personal injuries, explosions, fires, and down time.

All of this time I have been talking about equipment and plant layout

*Chairman operating committee, Phillips Petroleum Co. and vice president, Phillips Chemical Co. Paper presented at N.G.A.A. meeting, Houston, May 1.

with the assumption that lines, vessels, and boilers are used which meet the codes like the A.P.I.-A.S.M.E. codes for unfired vessels, A.S.M.E. codes for boilers and unfired pressure vessels, the A.S.A. code for pressure piping, and standards for liquefied petroleum gases. Federal, state, county, and local regulations, as well as codes by other regulatory bodies, should be incorporated within practical limits and based on past experience.

Safety Requirements

A. Planning stage. — Safety engineering is an integrated part of the natural-gasoline business from the time we plan to build a plant and on through until we get our last dollar of revenue from this installation. When cost estimates are made for the construction of a new plant, **money has to be included,** not set aside, for such expenditures as fire-fighting facilities, fireproofing, dikes, pressure-relieving devices, automatic and manual shutdown equipment, working platforms for aboveground elevations, walkways, guarding of moving equipment, handrails, lighting, explosionproof electrical equipment, and the arrangement of **plant equipment to reduce accident and fire hazards** resulting from exposure should be given serious thought.

The safety engineer should be charged with the responsibility to make certain that all these items are included in the original planning stage. The process, design, and construction engineers must place the **safety engineer** on their list of "people to **approve**" of any **plans** that are in the making for **new plants** or **plant extensions** if we are to make our industry the safest possible.

To prove my point I will relate an experience in one of our plants. A plant approximately 20 years old at the time of this accident had a pump with a chain drive, the sprockets and chain being unguarded. Our newly formed safety section asked the plant superintendent to guard the chain and sprockets. Our safety representative got the time-hardened advice that the pump had been operating 20 years without injury. Approximately 18 months later an employe had part of one finger cut off in this chain-and-sprocket arrangement. The average direct and indirect cost of lost-time finger injuries is $900. How many guards could have been installed 20 years ago for $900? Not mentioning the pain and suffering experienced by the employe, which cannot be measured in dollars and cents.

B. Fire-fighting facilities. — These should be engineered to give proper coverage for all plant areas and since their use comes into play after an accident has occurred, they must be placed out of the danger area readily accessible for use within the danger area. This has reference to fire hydrants, hose and hose carts, foam equipment, first-aid hand extinguishers, and fire pumps. Fireproofing of certain vessels, lines, and structural-steel supports have proved invaluable in controlling the spread of fire.

Fire walls and dikes will minimize the fire damage in transfer pump houses and storage areas. There is a definite need for a manual for fire protection in natural-gasoline plants, based on the past combined experiences of many companies. Our industry management and safety men recognize this need and are presently working on such a manual through the Natural Gasoline Committee of the Joint Central Committee on Accident Prevention and Central Committee on Fire Protection of the A.P.I. which when completed will serve as a guide to our industry.

Since the biggest value of water in the average gasoline-plant fire is for cooling purposes and controlling the spread of the fire, conservation of water while fighting fires in plants located in arid parts of the country is a serious engineering problem. However, if a plant is fortunate enough to tie the suction of their fire pumps into a lake, river, or the gulf, the problem isn't quite as acute. At least one of the drives for the fire pumps should have its source of fuel or power independent of all plants

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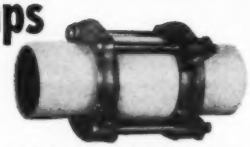

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and public utilities, thus making water for fire-fighting purposes available during utility outages, which often is the case after a serious explosion or during a bad fire.

C. Manual and automatic shutdown devices.—These are an engineering necessity in gasoline-plant operations to cut off and snuff the sources of ignition for escaping hydrocarbons. Visual and audible devices are used to warn operators of an upset in operations. Compressor engines are equipped with governors to control their speed; however, due to past experience of flywheel disintegrations which resulted in equipment damage, fires, and even fatalities, overspeed switches had to be designed to ground out the ignition system. Our experience shows that these automatic shutdown devices have cut down the number of fatalities, reduced pain and suffering inflicted on our employes, and have been an economical asset to the industry in the reduction of fire and equipment damage.

We employ the use of a high liquid-level shutdown device on inlet scrubbers to our compressors. In the years 1950 and 1951 we had a total of 40 warranted shutdowns. The warranted shutdowns are those when liquid did actuate the shutdown device grounding the compressor engines the scrubbers serve and even though our scrubbers are equipped with automatic dumps, on occasion liquid has entered the scrubbers so fast to make them ineffective.

We have had two specific examples of this type problem:

1. On July 27, 1950, a 515-psi. 4-in. discharge line ruptured adjacent to a compressor building allowing millions of cubic feet of gas to backflow from a sales transmission line and escape at the point of rupture. All sources of ignition were removed when the manual shutdown system was actuated. All engines were grounded and fuel to the boilers was cut off and steam turned into the fire boxes. You can imagine the amount of damage had this gas ignited.

2. On February 3, 1952, at one of our gas-compressor plants a fire was caused by a high liquid level in the low-stage accumulator, allowing liquid to be taken into a compressor resulting in a compressor-head failure on the high-compression side. The accumulator was equipped with a high-level alarm which sounded the warning, but before the liquid level could be drawn down the liquid entered the compressor.

Climatic Equipment Protection

Climatic conditions dictate the type of building and equipment protection that should be provided for plant equipment. The three extremes are the Gulf Coast area with excessive rains, the West Texas area with its abundance of moving-blowing sand, and the Rocky Mountain and northern regions with subzero temperatures of long durations in winter seasons. You all know the problems, each of these conditions presents with the major one applicable to all three areas being the latter. Freezeups can cause a lot of damage in a very short time as well as endanger the lives of those operating equipment.

Air, Water, and Surface Pollution

Health and safety engineering have to be incorporated to combat smoke and smog problems; the combustion of or harnessing of obnoxious gases such as the H_2S problem in West Texas and in the mid-Rocky Mountain region, provision of a well-designed plant drainage system with skimmer ponds to eliminate pollution of stream, rivers, and oyster beds, all of these are within the responsibility scope of the safety engineer.

Personnel and Job Training

Regardless of how well a plant is designed, as long as we have to deal with the human element to operate and maintain these plants it is still possible to have personal injuries, equipment damage, explosions, and fires. To eliminate these potentialities, management is faced with a never-ending training program. I will not go into this very deeply, but because of its paramount importance will make one more comment on

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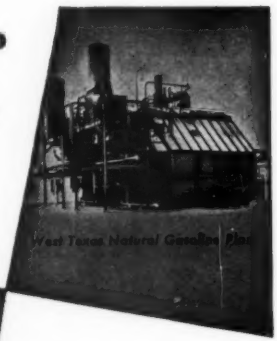
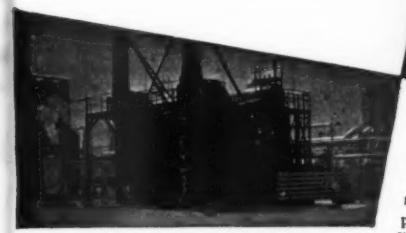


West Texas Natural Gasoline Plant



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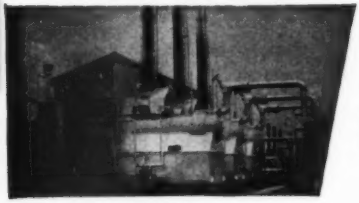
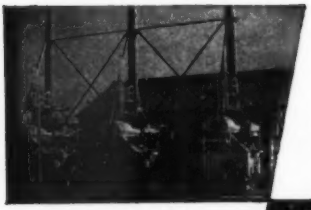


Louisiana Refinery



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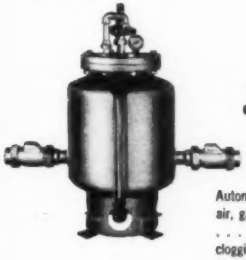

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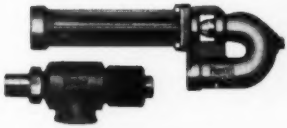

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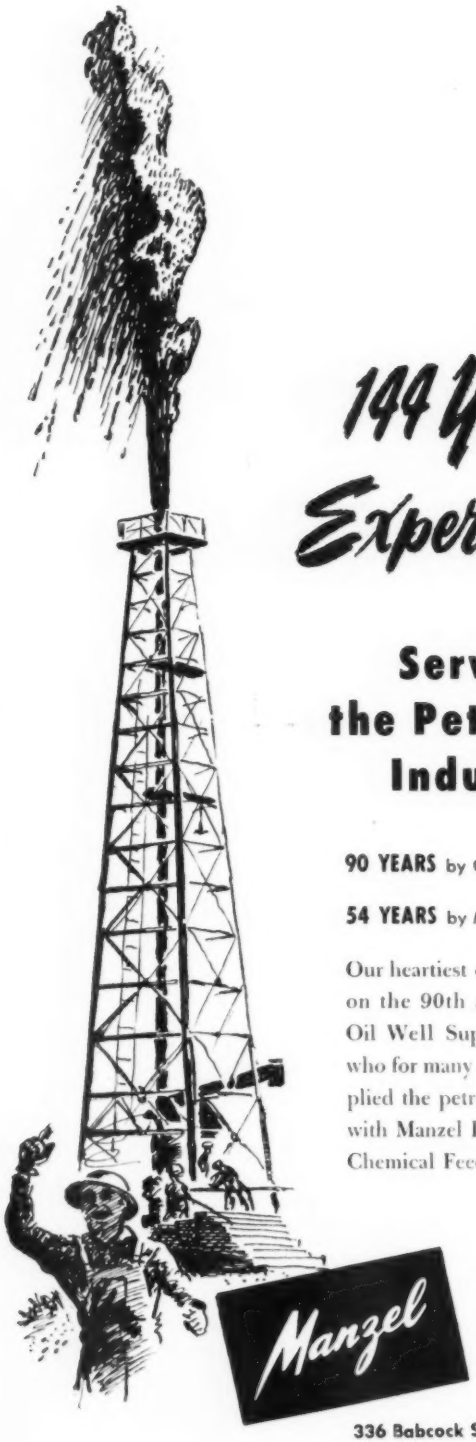

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training, that being that safety and safety engineering is not an extra-curricular activity in industry, it is a part of the production job. It should never be set aside as a separate package. It should be worked in with every job and when training manuals and specific job writeups are edited and when training courses are held with the employes, safety should be a part of the training as surely as the 4-ton flywheel is a part of a 230-hp. horizontal compressor engine.

Colleges and universities must add safety engineering to their curricula to broaden the scope of the engineering and technical graduate to the point where it will not only be a greater asset to industry but will add to the safety and welfare to the nation as a whole. Oklahoma A. & M. College has 7 hours of such courses. "Industrial Safety," "The Human Element in Accident Prevention," and "Safety Engineering," a part of which is required of all graduates of the various schools of engineering and technical training.

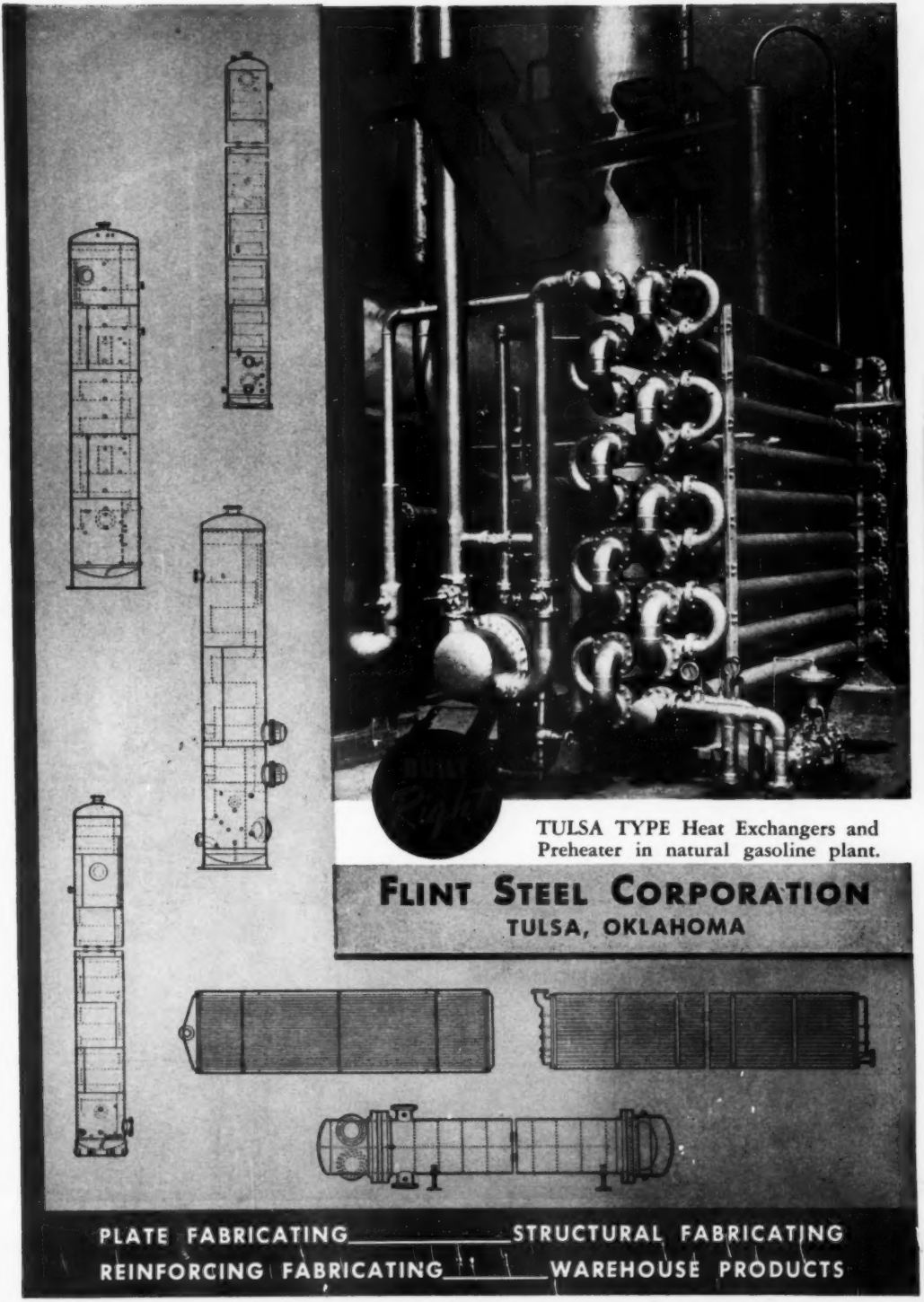
Yes, there is a place for safety engineering in the natural-gasoline business, and I feel that we have progressed a lot in the last decade, but there is still room for additional research and improvement in all phases of the business, process, design, construction, operation, maintenance, training of employes, and last but not least the indoctrination of safety in both old and new employes.

The graph shows what has happened in our own company to accident frequency when management has led the program of improving old and building new plants for safe operation and sponsoring a well-rounded employe safety program and personal interest in safety. As management takes this leadership attitude it increases the employes morale. Although you keep adding more equipment to existing plants and building new and more complex processes, all calling for more manpower and greater job responsibility, if good morale exists, accidents will continue to decrease.

We must not leave this entire responsibility to our engineers, designers, operators, or safety men, but as management we must lead in this important problem. Only as we put our shoulders to removing the obstacles to safety, will our industry be the safest one in which to work. The challenge is to every employe with our backing.

Dry Ice from Petroleum

A process for making high-quality dry ice from natural gas containing gaseous to heavy crude oil hydrocarbons has been perfected by oil scientists. The product is odorless, colorless, tasteless and non-toxic, so it is suitable for use in the refrigeration of foods.


TULSA TYPE Heat Exchangers and Preheater in natural gasoline plant.
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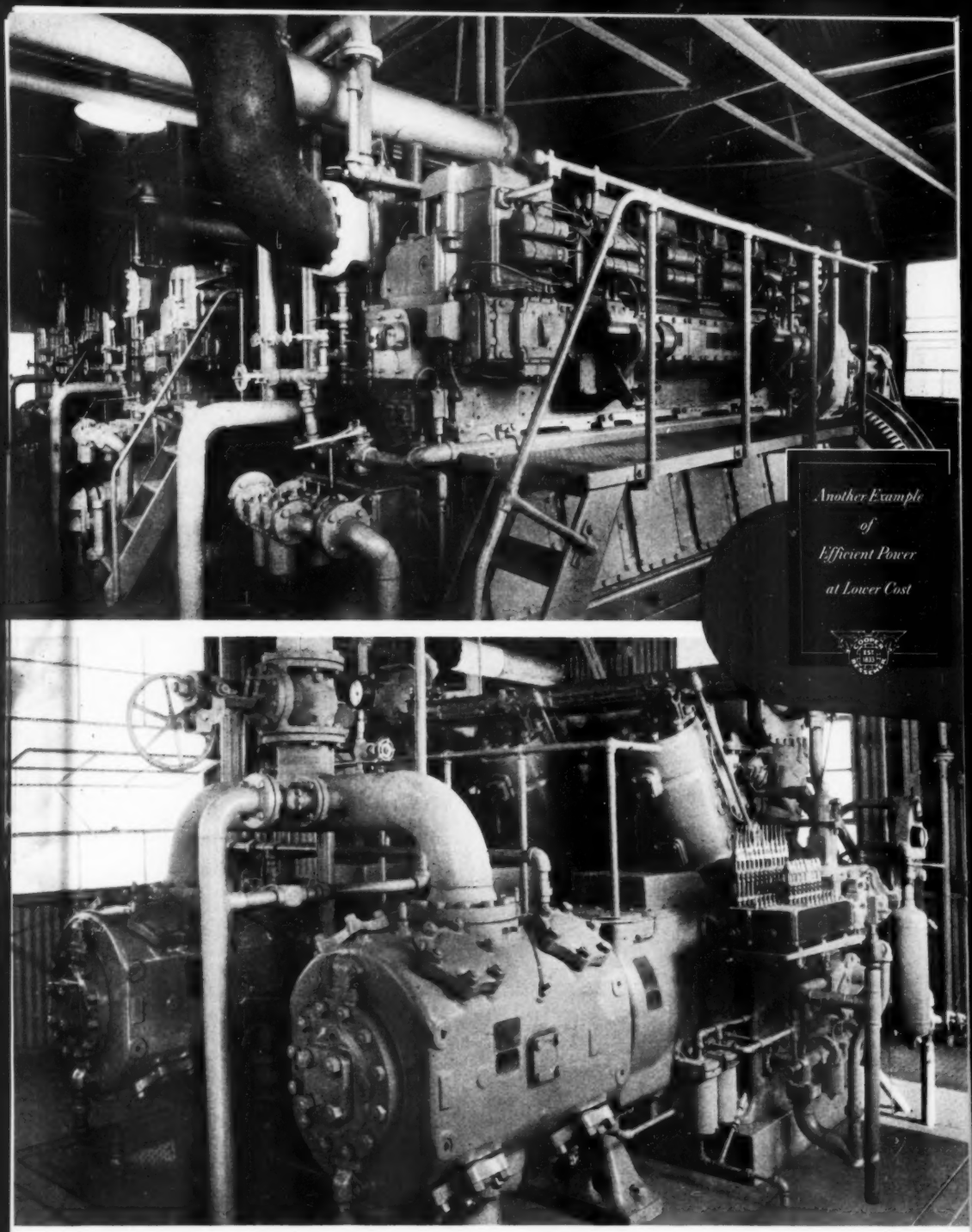

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The new natural gasoline plant of the Hugoton Plains Gas and Oil Company, now operating about a year, is powered by the Cooper-Bessemer units shown opposite. These consist of three JS-6 540 hp gas engines driving 368 KW A.C. generators, and a 308 hp GMX V-angle compressor.

This interesting field processing plant, engineered and constructed by J. F. Pritchard & Company, serves 176 gas wells, operates without steam, and efficiently produces natural gasoline, propane, butane and iso butane. Residue gas goes into Northern Natural's system.

The three JS gas engines operate 24 hours a day, furnish all electric power required to operate the plant. Using Cooper-Bessemer's latest development in high compression operation, these modern engines attain 34.4% thermal efficiency, holding fuel consumption to less than 7400 BTU/bhp/hr.

The GMX is used as a propane refrigeration unit. And here, as in other processing services, this modern Cooper-Bessemer V-angle compressor is showing a consistent record of trouble-free, low-cost performance under continuous operation.

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The author, a mining engineer, with a background in mine development and operation, presents some aspects of

Excavating Underground L. P. G. Storage

by R. L. Loofbourow*

In brief:

1. The general location for an underground storage must be chosen with respect to production, transportation, or consumption of L.P.G.

2. Our problem is to find at these general locations a suitable mass of tight, preferably strong rock, and to determine its tightness and strength before heavy expenditures for digging are begun. If no tight mass of rock is available, we have to develop some ready method of sealing permeable rock.

3. To lay out the best arrangement of chambers and to provide means to excavate and handle broken rock. In other words, to design the storage so that construction can be planned, costs estimated, and work done in an orderly manner.

THE object of excavating for underground storage is to create, at moderate cost and at a desired location, a sizable and secure storage using materials which are available. If the storage is near a point of consumption, it may be considered that we are attempting to store both products and transportation, in the sense that we are building storage which can be charged during periods of low consumption and discharged when demand is high. Because of these objectives, a producer and/or marketer will probably choose the general location. Then, within the area so located, a site will be selected with regard to topography, rock, access, utilities, and other factors to be discussed.

Lining

Concrete lining is expensive. The extra cost of lining a storage of moderate capacity with concrete may be something in the neighborhood of $2 per barrel of capacity. Concrete itself is not impervious and requires surface treatment. During the war both the Army and Navy experimented with coatings of many types. Some published results indicate that they achieved success with thiokol latex. It is not known whether this material would be suitable for use on rock. So far as I am aware, no one has planned or built underground L.P.G. storage with concrete lining. Much more research is needed to discover a lining material for an inexpensive application to rock surfaces. It should, of course, be inert as far as L.P.G. and water are concerned, be capable of application on damp surfaces, be nontoxic, and should have some plasticity.

*Mine contracting department, E. J. Longyear Co., Minneapolis. Presented at N.G.A.A. meeting, Houston, May 1-2, 1952.

Geology

Since the cost of lining with surface-coated concrete is high and since at the present time we do not have much information on satisfactory sealing compounds, it is important to find a rock which is tight enough to hold propane and to find a mass of this rock sufficiently large to allow us to excavate chambers in it. All parts of the earth's crust have been subjected to some folding or squeezing as the result of movement. In some areas the effects of these movements are more intense than in others. In the Mid-Continent, we are fortunate that movement has been slight. Strong rocks, such as limestone, quartzite, and granite, are more likely to crack when subjected to movement than softer rocks such as siltstone, shale, or soft sandstone. The ideal material in which to excavate a storage would be a thick bed of tight massive, moderately strong rock. In such a rock we could excavate large chambers. Perfection in nature is rare. It is more likely we have to work with a rock of lower strength and open smaller chambers. We may find a tight, strong bed near the top of a weaker but still tight horizon. It may be possible, then, to use the strong bed as a part of the chamber roof.

Mining

From the standpoint of compactness, the ideal storage underground, as on the surface, would be one great spherical chamber. Many things conspire to make this difficult. The bed of rock chosen as most suitable may be of limited thickness. Its stability limits the size of openings that can be excavated safely. It is difficult to approach a spherical shape in excavation by drilling and blasting, or any other known means of digging hard rock. Finally, we have to provide a quick and preferably an easy means to gather and remove rock broken in the excavation. It is likely that we will compromise with chambers of modified circular or rectangular cross-section, arranged with their long dimensions vertical or horizontal.

The size of chamber that can be safely opened depends on the physical character of the rock bed chosen. The maximum size of stable openings can be large if rock conditions are favorable. Examples of openings 50 to 100 ft. wide, several hundred feet long, and 50 or more feet in height could be given, but these are rare. It is more likely that we have to plan on smaller openings 20 to 40 ft. in width, and, in some cases, 5 to 10 ft. might be a maximum for unsupported openings. Variation is high.

The strength of the rock, its compactness, freedom from **bedding**, cleavage and joint cracks, and its stability on exposure to damp air and propane are particularly important. The permeability of the rock mass and other physical properties will determine the natural tightness of the chamber — hence our preoccupation with physical properties and our need to determine them before digging is begun.

The problem of stability has two parts: (1) stability during construction, where we are principally concerned with the safety of crew and satisfactory completion of the job; and (2) permanent stability; if we are to store a product under pressure, then this pressure will help to support the roof of the excavation and will lessen its tendency to cave. Finally, chambers should be arranged as close as possible to the shaft or other entrance to lessen the amount of haulage, and some provision must be made for gathering broken rock at places where it may be loaded, scraped, or conveyed away from the excavation.

Preliminary Site Investigation

The cost of preliminary study is moderate and will include the following items:

1. Topography of the desired location, ownership, availability of power, access roads, water, etc.

2. Nature of overburden and bedrock as shown in well logs, road cuts, or other excavations.

3. Depth to water table and the vol-

"Ideally, underground storage, as on the surface, would be one great spherical chamber."

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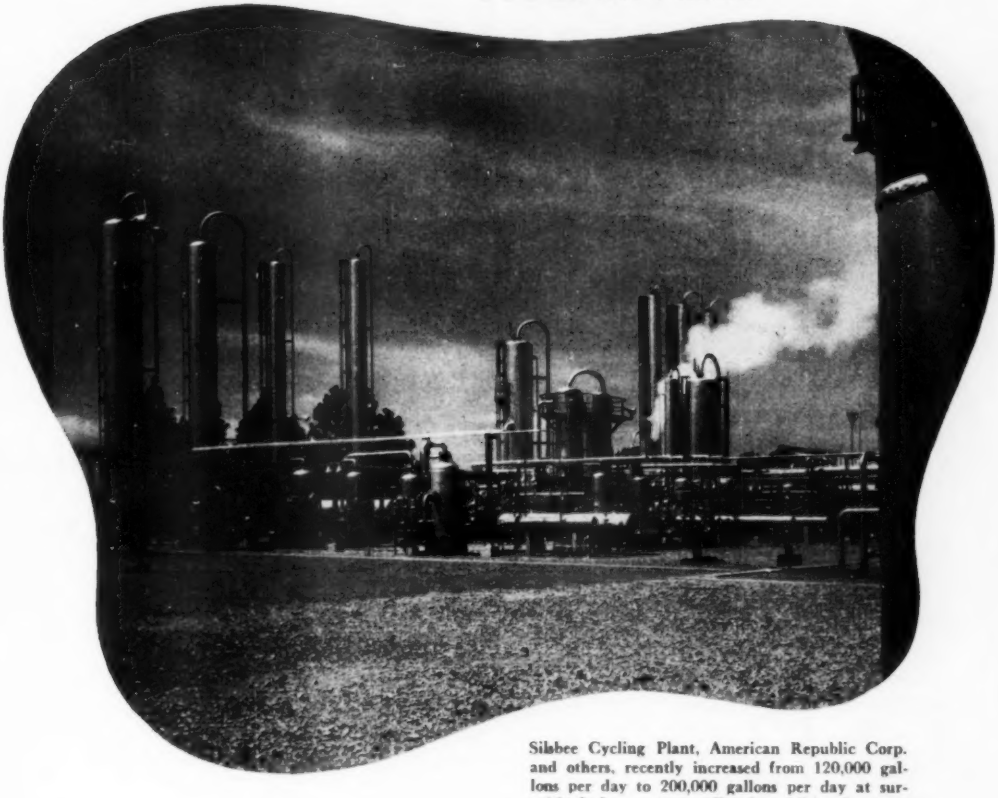

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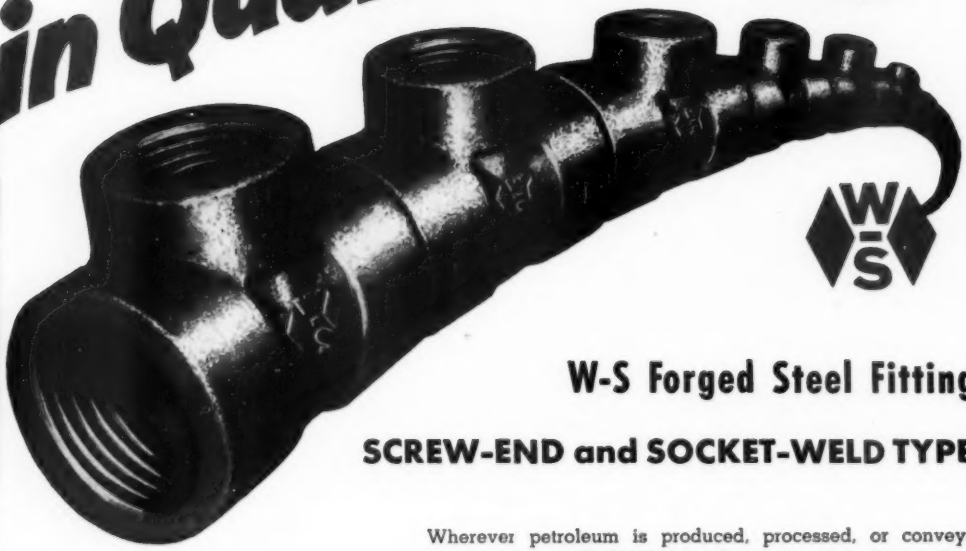

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ume of water available at various horizons.

4. Suitability of the site as to room for construction operations and for dumping waste rock, etc., and possible sale of rock for aggregate, fill, or other purposes.

Some of this information will be available by an inspection of the site; some, such as well logs and a description of rocks, may be found in private, state, or federal geological reports. For a complete preliminary evaluation, it is believed that at least one core-drill hole should be drilled to the greatest depth at which storage might be located. Pressure testing of this hole will give at least a preliminary idea of the tightness of the ground. It should be carried out in increments of about 10 ft.

Detailed Study of the Site

The principal tool which we have for detailed study is additional core drilling and the study of the core and the holes. The object of this study will be to determine the uniformity of the rock, the thickness and attitude of favorable beds, the mechanical strength of these beds, the chemical suitability of the rock, and its permeability. All evidence of weakness, such as faulting, jointing, bedding, and cleavage will be very carefully studied. Holes should be pressure tested. Core may also be tested for permeability, mechanical strength, the effect of air, moisture, and product on the core, and a partial analysis of the core taken from various favorable beds may help. Drilling progress will show relative drillability of various rocks encountered.

The interpretation of this investigation and the layout of underground workings from it is difficult, but the attempt must be made in order to plan underground work, to estimate the time and cost of the work, and to forecast its usefulness. Experience and judgment play an important part in this. It must always be remembered that drill core has not been subject to concussion, but that the walls or any underground openings created by drilling and blasting are subjected to it. The effect of this concussion is to open up incipient cracks or cleavages in rock, and openings so excavated will present a much more ragged appearance than the core indicates.

The rocks which must be traversed in gaining access to the chambers will be studied carefully to determine if any special problems in shaft sinking or tunnel driving are involved.

Storage Design

A column of rock 1 in. square weighs about 1.1 lb. per ft., or rock exerts a pressure due to its own weight of about 110 lb. per 100 ft. of depth. Viewed conservatively, the permanent safety of underground storage requires that rock weight above the storage be at least equal to the force exerted upward by the product stored. Therefore, the top of a storage to operate at a maximum of 200 lb. pressure should be at least some 180 ft. deep.

If topography is rugged, it may be possible to enter chambers through a tunnel, which will usually be less expensive than a shaft. Either shaft or tunnel must be designed for access of crew, supplies, and equipment, for removal of rock to be excavated, and for later installation of input or output lines, any gages desired, and for the removal of water which may accumulate in the storage itself. In addition to the principal entry by shaft or tunnel, it will usually be desirable to provide for ventilation to remove smoke and dust occasioned by blasting during the period of construction. This may be done through moderate-sized bore holes. If it is desirable, these may later be used for pipe lines.

If multiple chambers are required, they should be arranged as compactly as possible to simplify transportation of supplies and broken rock, and reduce the footage of entries. In general, it is less expensive to excavate a large chamber than to obtain the equivalent volume in many small openings. This is because in large openings gravity and mechanical means can be more readily used for loading and because more rock can

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be broken with the same amount of drilling and blasting.

If storage is to be built through a tunnel, we can use tunnel-driving equipment such as jumbos, carrying a number of percussion-type rock drills; crawler-mounted loaders, and trucks for removing broken rock. The only serious complication in the construction of storage by this means will be a bulkhead, or bulkheads, sufficiently large to fill the entrance to the tunnel and sufficiently strong to withstand the pressure. These can be built of concrete and can be made tight against the roof of the tunnel, first, by carefully placing the concrete and, second, by grouting through holes drilled in the concrete after it has set.

If access to the chambers must be through a shaft, a hoist will be provided first to sink the shaft itself, and then to remove rock broken in horizontal openings, and, finally, to hoist rock broken in the chambers. The shaft is intended to traverse various materials such as soil, gravel, sand, and partially decomposed rock, all probably saturated, before reaching the depth at which chambers are located; some special shaft sinking problems may be involved. It will be particularly desirable to seal off any water. To minimize this complication, the shaft will probably be as small as possible. This will make it desirable to use light, small equipment in underground work. Fortunately, such equipment is available and is commonly used in mining. If work is adequately planned, no serious loss in efficiency need result. The operation of a large mine hoist is complicated by the fact that it draws a high surge of power in accelerating a heavy load. It is, therefore, particularly desirable that the site be served by adequate power lines.

Costs

After a number of storages have been built, it is likely that their cost will be found to vary because of—

1. Capacity.
2. Depth.
3. Differences in overlying material.
4. Differences in the material surrounding the chambers.
5. Differences in methods used.
6. Costs of any treatment which the walls may require.
7. Differences in the cost of permanent installations desired.
8. Regional differences in the cost of labor and supplies.

The same factors make it difficult to give any general forecast of costs. However, costs may range between $8 and $2 per barrel of capacity for unlined storages of 50,000 to 200,000 bbl. in volume. The above costs should be sufficient to allow for all labor, supervision, equipment, and supplies, and permanent underground installation of pipe, valves, and pumps.

In the above range of volumes, it would be prudent to allow a year for detailed study and construction.

Conclusion

We regard the excavation of underground L.P.G. storage as akin to mining construction, though differing from it conspicuously in that openings must be tight. We have faith that underground storage is useful and feasible. We recognize some problems such as the accurate interpretation of the results of core drilling and the problem of sealing rock which is less than ideally impervious. These problems are difficult, but we believe they can be and will be solved.

BOOK

TULSA GEOLOGICAL SOCIETY DIGEST Volume XIX, 1951. Edited by Harold E. Enlows, Geological Department, University of Tulsa. 338 pp. $2.

Included in this digest is a summary of all technical programs and luncheon meetings held by the Tulsa Geological Society during the 1950-51 fiscal year. Condensations of technical papers presented at these meetings, with related graphic material, are included. Three recent geological theses, considered as "contributions to local geology," are given in full. Included in this digest for the first time is a complete bibliography and index of all Tulsa Geological Society Digest volumes I-XVIII. As in former years the digest contains a listing of former and present officers, committees, and a directory of members.

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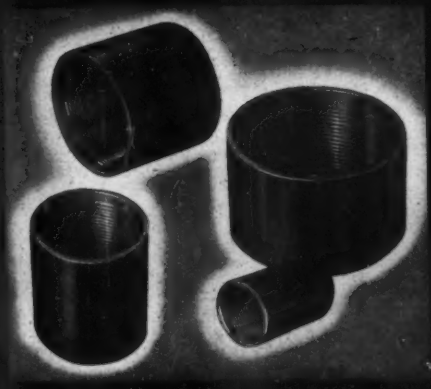

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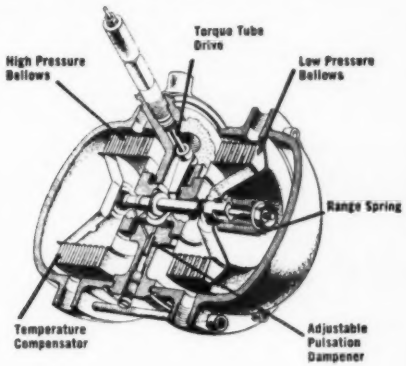

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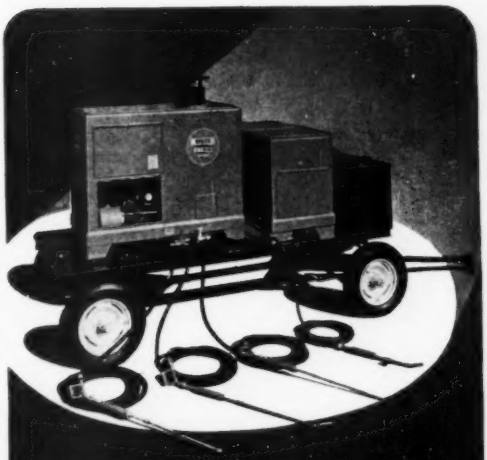

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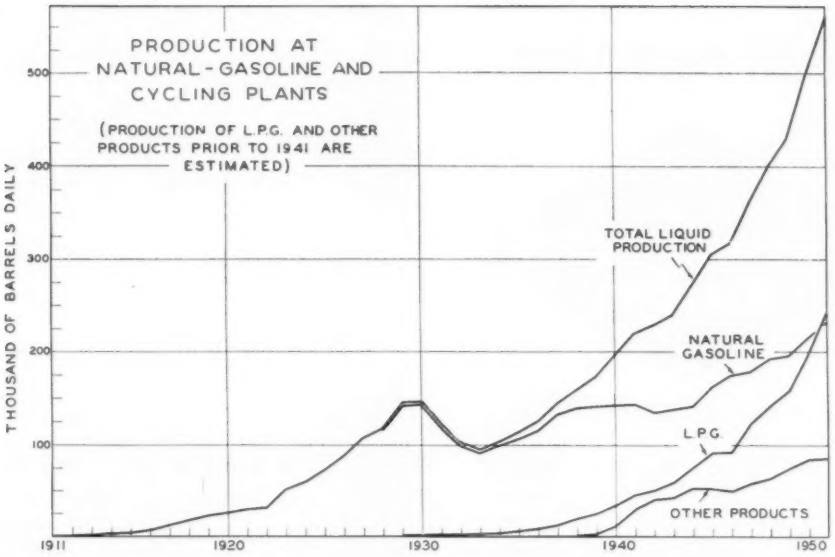

Output of Field Processing Plants Nears 10 Per Cent of Crude Production

by John C. Casper
Associate Editor

PRODUCTION at natural-gasoline and cycling plants averaged 614,000 bbl. daily in January, equivalent to 9.88 per cent of the crude production rate in that month. With larger percentage increases forecast for plant output than for crude production in 1952, the ratio is expected to be slightly more than 10 per cent for the late months of this year.

The relative growth of light-hydrocarbon production compared with that of crude is shown by the ratios of light products to crude. In 1921 the light-products production rate was 2.27 per cent of the crude production rate. By 1931 the ratio had climbed to 5.12 per cent but was up to only 5.27 per cent by 1941. The 1951 ratio was 9.16 per cent.

First reports of natural-gasoline production on a nation-wide basis were in 1911. In that year 176 small plants produced 177,000 bbl. of natural gasoline with value at plant estimated at $532,000. For 1951, total production was 205,512,000 bbl. or about 1,161 times as large as the output in 1911. The value of the 1951 production was more than half a billion dollars. For comparison, crude production in 1951 was 10.2 times production in 1911.

Total production from all 176 operating plants in 1911 was only 20,300 gal. daily. The average capacity of plants reported in the survey starting on page 222 of this issue is 64,760 gal. daily. In other words, the average plant today has a capacity equal to more than three times production at all plants in 1911. The Humble Oil & Refining Co. plant at Katy field in Texas can produce more in 2 weeks than all plants in 1911 operating for a full year.

The marked change in size of plants in the last 40 years is shown by the total capacity of 20,300 gal. daily for all 176 plants operating in 1911 compared with single-plant average in 1952 of almost 65,000 gal. daily. The trend for the past 20 years is indicated by the lines on the charts showing number of plants and capacities.

Between 1932 and 1941, there was a gradual increase in total capacity and a rapid drop in the number of operating plants. The rate of decrease in number of plants was slightly less in the 1941-52 period, but the trend still was toward fewer plants. Plant capacity increased for the years 1941 to 1947, but the big gains came in the 1947-52 period. Total capacity has almost doubled since 1947.

In 1911 the only state west of the Mississippi River with enough production to be listed separately was Oklahoma with a total of 383,000 gal. for the year. Ohio, Pennsylvania, and West Virginia accounted for 92 per cent of total production.

West Virginia held first place in plant production from 1911 through 1913. Oklahoma took the lead in 1914 and held it until rapid increases in California gave that state first place in 1929. Texas became the leader in 1938 and has been at the top continuously since that time.

For 1951 the top four states in order of production were Texas with 52.9 per cent of the total, California with 14.4 per cent, Louisiana with 10.9 per cent, and Oklahoma with 8.4 per cent.

These same states also hold the top four places in reserves of natural-gas liquids, but the order is changed by a shift between Louisiana and California.

The southwestern states of Texas, New Mexico, Louisiana, Mississippi, Arkansas, Oklahoma, and Kansas have 88.2 per cent of total reserves of natural-gas liquids and had 78.7 per cent of 1951 production. These southwestern states supplied 83.1 per cent of the volumetric increase in

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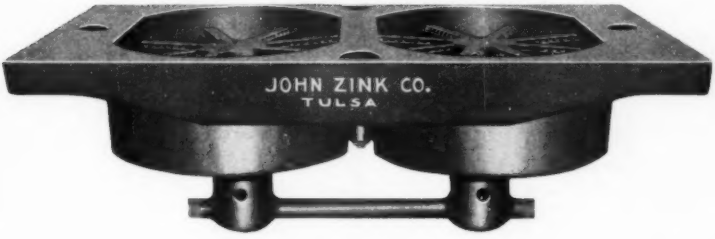

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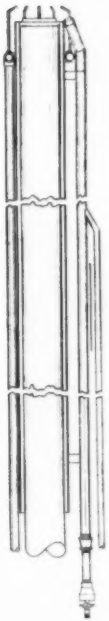

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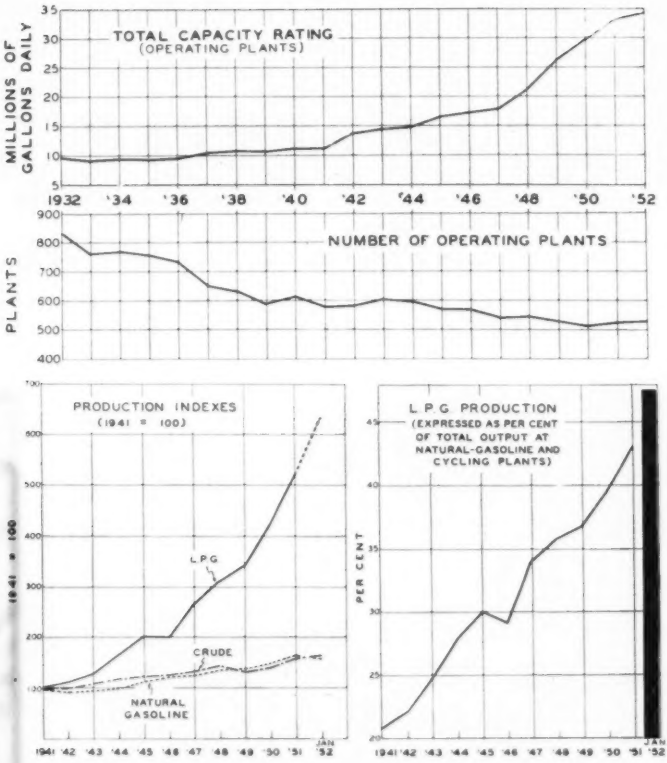

production between 1941 and 1951, and the high percentage of reserves indicates that the major portion of increases for the next few years also will come from these same states.

Gains in production of L.P.G. in the past 10 years have been principal reasons for the outstanding increases by natural-gasoline and cycling plants. The chart of production indexes shows that the relative increases in output of natural gasoline since 1941 have been about equal to the percentage increases in production of crude oil, both moving from 100 to about 160 for increases of near 60 per cent. On the other hand, the L.P.G. index reached 633 in 1951 for an increase of 533 per cent over production in 1941.

L.P.G. accounted for only 20.8 per cent of total production at natural-gasoline and cycling plants in 1941 but had climbed to 43 per cent of the total in 1951. On an annual production basis, 1951 was the first year in which L.P.G. output at plants exceeded natural-gasoline production.

The big increases in production of L.P.G. and the concentration of the production in the Southwest present problems in storage and transportation. The seasonal nature of L.P.G. demand requires some inventory buildup during the summer months.

PRODUCTION AT NATURAL-GASOLINE AND CYCLING PLANTS
(Thousands of barrels)

	1951	1941	Per cent increase
Eastern	6,385	2,912	119
Illinois*	2,992	2,355	27
Kentucky	2,082	842	147
Kansas	4,215	2,040	107
Oklahoma	17,207	10,795	59
Texas	108,627	37,115	193
Arkansas	2,363	818	189
Louisiana	22,361	5,374	316
Mississipi	1,181		
New Mexico	5,725	1,928	197
Rocky Mtn.	2,800	968	189
California	29,574	15,708	88
Total	205,512	80,855	154
Daily average	563	222	

*Includes Michigan.

CURRENT PRODUCTION AT NATURAL-GASOLINE AND CYCLING PLANTS
(Thousands of barrels)

	Jan. 1952	Jan. 1951	Per cent increase
Eastern	503	591	—14.9
Illinois*	247	251	— 1.6
Kentucky	401	171	134.5
Kansas	461	406	13.5
Oklahoma	1,685	1,403	20.1
Texas	9,967	8,985	10.9
Arkansas	220	173	27.2
Louisiana	1,956	1,957	.5
Mississippi	99	109	— 9.2
New Mexico	512	454	12.8
Rocky Mtn.	267	227	17.6
California	2,707	2,578	5.0
Total	19,035	17,305	10.0
Daily average	614	558	

*Includes Michigan.

In the past, most of the material has moved by tank car with a possibility of a transportation shortage during the winter months.

Suppliers and distributors are working toward a solution of the problem through increases in storage capacity, both underground and steel tankage. Some of this storage will be near points of consumption to relieve part of the transportation load in winter.

The high cost of rail transportation tends to limit the use of L.P.G. in some of the northern and eastern states to cooking and water heating at points where natural gas is not available. Use in chemical manufacture depends on availability of material at prices below current plant prices plus rail transportation to the North and East. For this reason, most of the petrochemical plants using plant-produced L.P.G. as feed stock have been located in the Southwest.

Last year an extraction plant was completed in Kentucky which took additional light products from the gas stream in one of the long-distance transmission lines. Part of these products are being used as feed stocks for a chemical plant. This method of handling may furnish a solution to the problem of supplying needed L.P.G. for chemical plants at points where normal methods of transportation would raise delivered price above the break-even point for a feed stock.

The completion of this plant in Kentucky raised the output in that state 135 per cent in the 12-month period ended January 1952. Kentucky ranked fifth in plant production of L.P.G. in January of this year.

The influence of the new plant in Kentucky is shown in the high percentage of L.P.G. in plant production. Total output of Kentucky plants in January was 401,000 bbl. of which 374,000 bbl. or 93.3 per cent was classified as L.P.G. The national average was 47.6 per cent L.P.G.

If this plan for locating extraction plants on natural-gas transmission lines becomes popular, it will be difficult to report production of natural-gas liquids by actual state of origin. The increase in plant output was reported for Kentucky, but the original material came from one or more of the southwestern states.

Production of finished motor fuel at natural-gasoline and cycling plants in 1951 was only 1.8 per cent of the volume produced at refineries, but the ratio of plant-produced motor fuel to the total has been increasing since the end of the war. Finished gasoline produced at natural-gasoline and cycling plants increased 149 per cent in the 6-year period from 1945 to 1951. Finished gasoline production at refineries gained 43 per cent in the same period. Part of the trend toward a greater percentage of plant output marketed as finished gasoline may have been due to increases in differentials between prices of natural gasoline and motor fuel.

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The plant was designed and constructed by HUDSON in collaboration with engineers of The Pure Oil Company.

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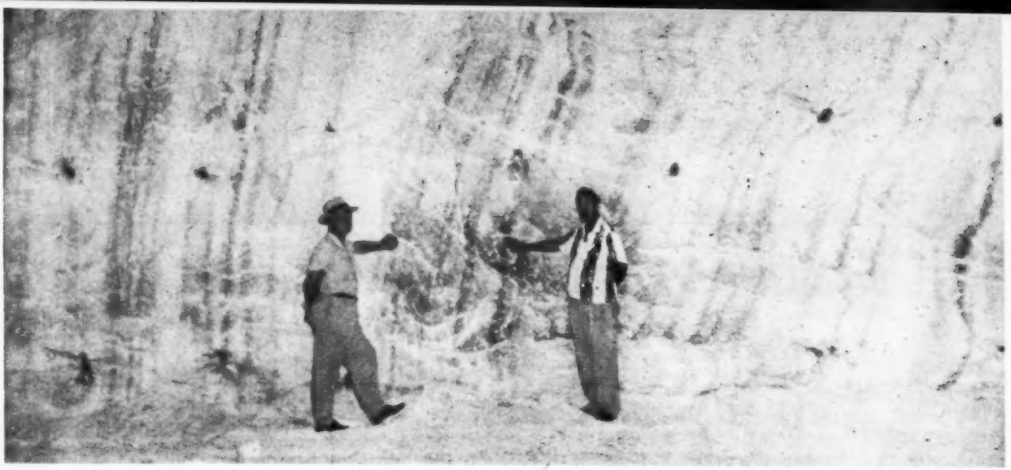


STRUCTURAL ASPECTS of a salt dome are shown in this picture of the interior of a Morton Salt Co. mine near Grand Saline, Tex.

How to Install and Operate Underground Storage Facilities

by H. G. Billue*

WHEN underground storage of liquefied petroleum gas was announced, all available information on the methods of installation and operation was presented. This was done to create interest in the method because production was being wasted or dumped on a weak market. This caused turmoil in the summer and repercussions in the winter that were heard even in Washington.

It was the intent then, as it is now, to present the method to the industry for its acceptance and use, but for some reason, difficulties arose. Management did not consider the whole aspect of the development.

*Security Underground Storage Co., Wichita Falls, Tex. Presented at annual meeting of N.G.A.A., Houston, April 30-May 2.

There are problems in locating underground storage, much the same as in locating oil. These problems are being solved, even though some of the solutions have been somewhat expensive.

Three Methods

There are three ways to obtain underground storage:

1. Use a means that has been successfully adapted in some other situation.
2. Devise a means of your own.
3. Hire a consultant.

There have been enough installations to provide plenty of information, but, unfortunately, this information has not been correlated and assembled as it should be. Erroneous reports have been circulated about different projects; therefore the use of a method previously successful guarantees nothing unless a detailed report of an installation that is very similar can be obtained.

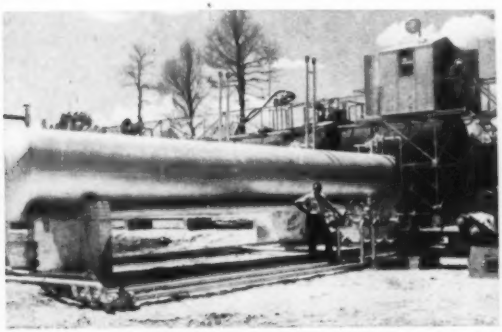
The second method, devising a means of your own, may have some advantages. A better way may be developed to provide underground storage. Some companies have formed their own organizations to do this work. They have installed storage but cannot evaluate the results since the reservoir is underground. They have disregarded some of the basic principles that make underground storage workable. Successful storage depends on the natural structural strength of the earth to retain liquids so they may be recovered.

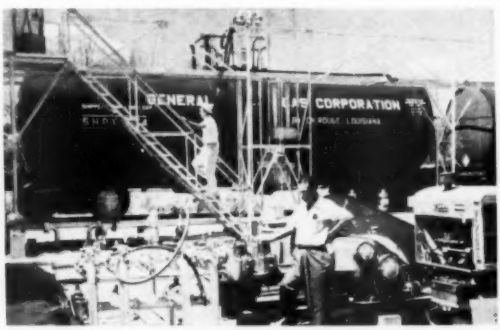
By hiring a consultant, his experience becomes available and also the experience of others with whom he has come in contact.

Problems

The problems encountered in developing underground storage are:

1. Location of proper strata.
2. Testing by core drilling, analysis of strata.





AUXILIARY FACILITIES for underground-storage projects are portrayed in these pictures. At left is an L.P.G. storage tank. At right is shown necessary equipment for loading and unloading tank cars.

UP TO 50% EXTRA THRUPUT *OBTAINED* BY USING KOCH KASKADE FRACTIONATING TRAYS

LEONARD REFINING CO.
ALMA, MICHIGAN

Obtained increased thruput on 72" I. D., TCC synthetic crude tower to capacities of:

	Liquid	Vapor
Volume	115,300 #/hr.	82,480 #/hr.
Density	45.1 #/cf.	175 #/cf.
△p/tray	.....	1.38" H_2O

Koch Kaskade trays were installed on present supports — 36" centers.

PHILLIPS PETROLEUM CO.
WOODS CROSS, UTAH, REFINERY

Obtained increased thruput on 30" diameter, 110# psig. poly stabilizer to capacities of:

	Liquid	Vapor
Volume	36,700 #/hr.	20,000 #/hr.
Density #/CF	29.6	1.317

Koch Kaskade trays were installed on 24" centers.

WARREN PETROLEUM CO.
RINGWOOD, OKLA., GASOLINE PLANT

Obtained increased capacity on 72" 750# natural gas absorber to:

	Liquid	Vapor
Volume	460 gpm (lean)	75 mm. CF/D
Density #/CF	38° API (lean)	2.43 #/CF

Koch Kaskade trays were installed on 26" centers.

When extra thruput is your problem, it will pay you to investigate the economy and operating efficiency of Koch Kaskade Fractionating Trays. Write us today — no obligation.

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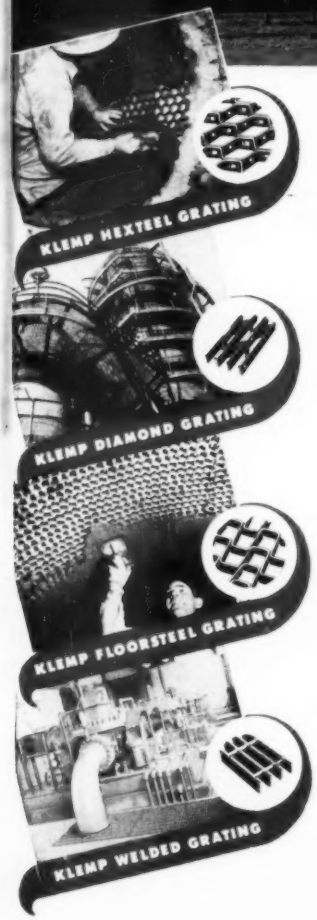

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3. Setting production string and drilling problems.
4. Setting of circulating string and associated pipe.
5. Circulating procedure.
6. Testing of completed well.
7. Operating procedure.
8. Operating facilities.
9. Operating personnel.
10. Safety.

Discussion of Problems

1. The **strata** adaptable to storage application are shales and salt formations. Detailed information is available on the most likely locations; however, further information must be obtained from existing wells or from core drilling. This, in some instances, has been expensive.

2. After the location is decided upon, the next procedure is to **core** the section, either through the contemplated hole or from a core hole drilled for this purpose. It is advisable to core the entire section and strive to acquire 100 per cent core, if possible. Then it is advisable to run an electric log to locate a possible sand stringer which might allow leakage of stored fluid.

From the coring analysis, decisions can be made as to where to set pipe and how to complete the well. It may be advisable to pass through some of the strata and plug back some of them. This may mean the difference between success and failure.

3. It is thus apparent that the **setting** of the production string is important. In order to set it, a hole must be drilled to proper depth. This isn't easy, particularly if lost circulation is encountered. This condition is very common on the domes of the Gulf Coast and is encountered occasionally in the bedded section.

Of course, if the section is known, proper preventive measures can be taken or the section drilled with cable tools. From the core analysis and the drilling results, a decision is made as to where to set the production string, that is, in the salt or a selected anhydrite, stringer, or through some of the salt section.

4. The setting of the circulating string is a very important item. Several strings have pumped off or whipped in two. In checking those that have come unscrewed and others that have sheared off under the collar, indications are that the joint held but that the whipping and whirling on the string caused the failure. In order to prevent these failures the string has sometimes been welded as it was run. In a number of these instances, trouble developed and the string had to be cut out and rerun. Heavy strings with weight set on the bottom seem to be most successful.

5. **Circulating procedures** have a lot to do with the shape of the hole. This is very important, especially in the bedded section. However, it is just as important in the domes, if the pipe

is set in the salt. It is easy to wash back of the pipe and form a trap that will cause trouble later.

6. **Testing of the well** should be carried out during washing beacuse the well can start going bad at a slow rate and can be ruined before it is known, if the washing isn't checked periodically. If the standard hydraulic test is made, giving the solution time to become saturated, successful storage conditions can be determined before product is admitted to the formation.

7. The method used in operating the installation is very important in that product recovery must be efficient.

Product can be displaced with saturated or fresh water. This seems to be the best method. It can be pumped out with a deep-well pump which this far has been impractical. Product can also pressured out with gas, but will be a little off specification. The worst thing that can happen is the hydraulic fracturing of the formation, resulting in loss of product and the hole. The basic principle of underground storage is the utilization of the natural structural strength of the earth. This will run about 0.7 psi. per foot of depth as safe working pressure. The average pressure at which fracturing occurs is 0.9 psi. per foot of depth, so working pressure must be known under every condition.

8. **Operating facilities.** — The N.G.-A.A. has a committee studying and making recommendations to the different state regulatory bodies on the facilities to be used at installations. The common gasoline-plant practice is adequate. But some states have requirements that are beyond those used in our modern plants, and the N.G.-A.A. is doing the industry a great service in standardizing the requirements.

The operation should be analyzed as to its particular requirements and the facilities designed accordingly. Orbit valves with standard fittings will generally suffice. The working pressure will be set up by the total depth of the well and can be calculated by multiplying the depth by 0.25 psi. In other words, a 1,000-ft. well will require 250-psi. fittings and a 2,000-ft. well 500-psi. fittings.

Standard compressor and pumping equipment may be used. A dehydrator will be necessary if propane is to be stored, and safety valves must be installed in blocked sections to relieve pressure from temperature rise.

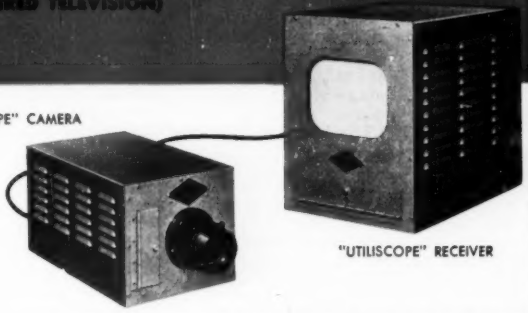
9. **Operating personnel.**—If storage is near an operating gasoline plant, it is obvious the plant operators will handle the storage operations. If the storage is located at marketing area away from plants, an operating procedure will have to be set up. It has been found that storage operation is very similar to loading-rack operations.

Ten cars in or out of storage is

(Continued on page 268)

Seeing more than Argus with the DIAMOND "UTILISCOPE"

(WIRED TELEVISION)



Argus, according to Greek mythology, had a hundred eyes, not all of which ever slept at once. He'd have been ideal for watching many industrial operations except that he couldn't see around corners, through walls, sit close to a potential explosion or look inside a furnace.

The Diamond "Utiliscope" (Wired Television) is much better than Argus with all his hundred eyes. The "eye" or camera is connected to the viewing screen by cable, so the "eye" can be practically anywhere . . . no matter how remote, dangerous, or difficult. Multiple "eyes" to any number are available just by adding more cameras and viewers. The "eyes" may be scattered all over a big plant, and all the images brought before one operator. Argus couldn't approach that.

And the "Utiliscope" doesn't sleep at all . . . will watch continuously 24 hours a day. Image is always clear and stable . . . the "Utiliscope" has no human limitations.

If you have any operation too remote, dangerous or inaccessible to observe directly . . . or if you need to have a single observer watch a number of widely scattered operations to assure their coordination, investigate the "Utiliscope." Write for Bulletin 1025-A.

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Analysis of Journal Survey Reveals . . .

Six Million Gallons of Additional Total Liquids Capacity Will Be Needed by End of 1953

by R. B. Tuttle
Associate Editor

ON a basis of total liquids, the combined capacity rating of natural-gas-processing plants in the United States, this year, exceeds 34 million gallon daily. This 1952 figure, an all-time high, is above that of 1951 by nearly 1,000,000 gallons daily, according to The Oil and Gas Journal's current annual survey of the nation's field-processing facilities. The 528 operating natural-gas-processing plants making up this capacity-rating figure include principally those installations which are operating in liquid-extraction service.

In the group of 528 field-processing plants are 51 units serving in condensate-field operations. The majority of the other 477 processing units fall within the general category of natural-gasoline plants. A few of the plants in this latter group are located on transmission lines, remote from producing areas. Another small number of plants included in the group are in pressure maintenance or repressuring operations. In general, operations involving only liquids separation are not included in the Journal's current survey.

Gain in total plant capacity for the 1951-1952 period is about 8 per cent below that for 1950-1951 on a projected basis. This break in uniform annual increases which started in 1947, results primarily from productive-capacity reductions for a large number of older plants. Although the total capacity reduction is comparatively large, according to Journal survey returns, the losses are offset by more than 800,000 gal. daily via new plants and capacity increases to existing plants.

SUMMARY OF NATURAL-GASOLINE PLANTS IN THE UNITED STATES—THEIR DISTRIBUTION AND CAPACITIES

	All plants*		Plants not producing L.P.G.		Plants producing L.P.G.	
	No. of plants	Liquid prod. (cap. gal. per day)	No. of plants	Liquid prod. (cap. gal. per day)	No. of plants	Liquid prod. (cap. gal. per day)
Arkansas	8	327,200	1	10,000	7	317,200
California	69	4,181,500	33	1,092,800	36	3,088,700
Colorado	1	68,000			1	68,000
Illinois	8	451,050	2	1,750	6	449,300
Kansas	14	804,930	3	135,000	11	669,930
Kentucky	5	485,000	2	10,000	3	475,000
Louisiana	33	1,272,440	10	118,000	23	1,154,440
Michigan	1	5,000	1	5,000		
Mississippi	1	19,950			1	19,950
Montana	1	30,000			1	30,000
Nebraska	1	36,000			1	36,000
New Mexico	12	785,900			12	785,900
Ohio	4	16,550	4	16,550		
Oklahoma	67	2,517,500	17	257,200	50	2,260,300
Pennsylvania	17	87,590	16	78,090	1	9,500
Texas	183	14,471,240	48	1,646,840	135	12,824,400
West Virginia	43	504,200	37	206,450	6	297,750
Wyoming	9	314,600	4	43,100	5	271,500
Total	477	26,378,650	178	3,620,780	299	22,757,870

*Capacity for natural-gasoline manufacture only, plus capacity for natural-gasoline and L.P.G. manufacture.

Trend Toward Larger Plants

To maintain the capacity expansion rate established in the 1947-1951 period, a substantial number of new plants will be required before the end of 1953. Obviously these plants would be of comparatively large capacity, following the pattern of recent years. Since today's average plant runs to approximately 65,000 gal. daily, around 75 "average" plants are needed to hold the line. However, today's new plant runs to about three times the capacity of the average plant in 1952, indicating that about 25 new plants of this capacity range are needed to maintain the uniform growth pattern through 1953. Such additional capacity as may be needed to compensate for drops in capacity of older plants could possibly raise the number of new plants, needed by 1953, to a total of 30.

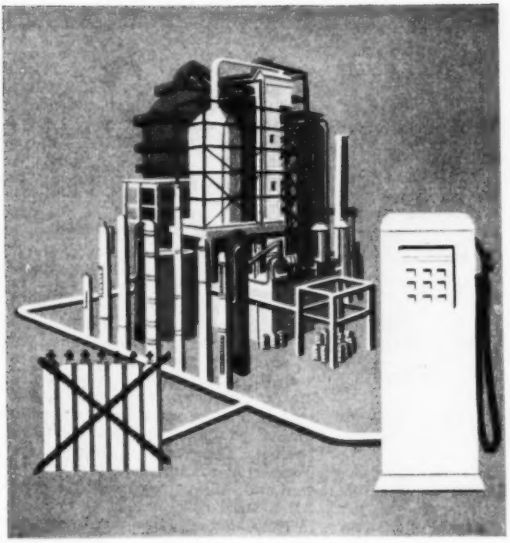
A comparison of Journal surveys on natural-gas-processing operations shows the trend toward large-capacity plants began about 20 years ago. Prior to that time average plant capacity increased at a relatively uniform annual rate of about 1,000 gal. daily. Average plant-capacity rating increased from around 8,900 gal. per day for all plants in 1930 (idle and operating), to 11,600 gal. per day for operating plants in early 1932. Over the following 4-year period, average plant capacity increased to 19,000 gal. daily, part of which resulted from cycling operations starting in 1938. Up to 1947 the greatest increase in average plant capacity rating occurred in the preceding 6 years. During this period, capacity of the average plant jumped to more than 33,000 gal. daily. In the past 5 years capacity rating on the average natural-gas-processing plant has nearly doubled, giving today's average plant a rating of nearly 65,000 gal. daily.

Distribution of Capacity

A breakdown on the Journal's current survey figures shows the 1952 average cycling plant has a capacity rating of 153,000 gal. daily or nearly three times that of this year's average natural-gasoline plant. Distribution by states shows Texas leads with 35 cycling and 183 natural-gasoline plants. California is second with 71 plants and Oklahoma is third with 69.

On total plant-capacity ratings Texas is in first position with slightly more than 15,000,000 gal. daily. In second place, California plants total 4,887,500 gal. per day of operating capacity. Louisiana takes third place with 3,188,000 gal. of daily capacity.

Capacity rating on the average cycling plant in Texas runs to around 330,000 gal. daily with gasoline plants



Sell Butane at Gasoline Price

THE VAPOR PRESSURE OF CATALYTICALLY CRACKED GASOLINE CAN BE AN IMPORTANT REVENUE FACTOR. TABULATED BELOW ARE TYPICAL FIGURES SHOWING THAT AT NORMAL CATALYTIC CRACKING YIELDS, FILTROL'S NATURAL CATALYST (GRADE 58) WILL PERMIT THE INCLUSION OF TWICE AS MUCH BUTANE AS OTHER CATALYSTS IN GENERAL USE. THIS REPRESENTS ABOUT $700 PER DAY ADVANTAGE FOR FILTROL CATALYST, EXCLUSIVE OF OTHER ADVANTAGES.

	FILTROL* CATALYST FLUID 58	OTHER CATALYSTS
FEED B/D	10,000	10,000
GASOLINE (C_5-420°F) B/D	4,800	4,400
RVP	5.0	6.8
OCTANE NO. F-1 CLEAR	90.0	91.6
OCTANE NO. F-1 + 3cc TEL	96.0	96.8
R.V.P. OF PRESSURED GASOLINE	10.0	10.0
B/D nC_4 REQUIRED FOR PRESSURING	500	250
TOTAL B/D 10# GASOLINE	5,300	4,650
DOLLAR ADVANTAGE (Basis 7c/gal. differential in sale price between n-butane and gasoline)	$700/D BUTANE SAVINGS ALONE	

OTHER
REASONS FOR USING
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CATALYSTS AND ADSORBENTS

*T.M. REG. U.S. PAT. OFF.

SUMMARY OF CYCLING PLANTS IN THE UNITED STATES—THEIR DISTRIBUTION AND CAPACITIES

	All plants*		Plants not producing L.P.G.		Plants producing L.P.G.	
	No. of plants	Liquid prod. (cap. gal. per day)	No. of plants	Liquid prod. (cap. gal. per day)	No. of plants	Liquid prod. (cap. gal. per day)
Arkansas	1	58,500			1	58,500
California	2	696,000			2	696,000
Colorado	1	27,000	1	27,000		
Louisiana	9	1,915,490			9	1,915,490
Mississippi	1	107,100			1	107,100
Oklahoma	2	332,000			2	332,000
Texas	35	4,676,400	11	530,500	24	4,145,900
Total	51	7,812,490	12	557,500	39	7,254,990

*Capacity for natural-gasoline manufacture only, plus capacity for natural-gasoline and L.P.G. manufacture.

averaging approximately 80,000 gal. daily per plant.

California cycling-plant capacities average nearly 350,000 gal. daily, 20,000 gal. per day higher than Texas averages. The average natural-gasoline plant in California has a rating of 60,000 gal. daily or 20,000 gal. per day below the average plant for Texas. Louisiana plant averages run to approximately 42,500 gal. daily on natural gasoline, 214,000 gal. per day on cycling. Plant averages in Oklahoma are 37,500 gal. daily for natural gasoline and 166,000 gal. daily for cycling.

Based on total liquids capacity ratings for all natural-gasoline plants in the country, the ratio of capacity including L.P.G. to that which does not include L.P.G. has been stepped up from 84.8 per cent in 1951 to 89.7 per cent in 1952. About 62.5 per cent of the plants operating this year are equipped to produce L.P.G. whereas only 60 per cent of the plants were so equipped last year.

In the larger natural-gas-processing states, Oklahoma leads with 74.7 per cent of its operating natural-gasoline plants equipped to produce L.P.G. Next is Texas with 73.5 per cent. Then come Louisiana with 69.7 per cent and California with 37.7 per cent. All natural-gasoline plants operating in New Mexico, Mississippi and Montana are equipped to produce L.P.G.

Survey of Natural-Gasoline Plants

Compiled by The Oil and Gas Journal's Statistical Department

ARKANSAS

Company, field or plant, and county	Approx. prod. (gal. per day)
Arkansas Fuel Oil Co., Columbia, Columbia	*90,000
Arkla Oil Co., North Rodessa, Miller	*50,000
Hiwan Oil & Gas Co., Atlanta, Columbia	*20,000
Lion Oil Co., Shuler, Union	*35,000
Magnolia Petroleum Co., Kenova, Union	*7,200
Querbes, J. R., Oil Co., Southfield, Union	10,000
Shell Oil Co., Magnolia, Columbia	*85,000
Sunray Oil Corp., Midway, Lafayette	*30,000
Total	327,200

*Includes L.P.G.

CALIFORNIA

Company, field or plant, and county	Approx. prod. (gal. per day)
Bankline Oil Co., Signal Hill, Los Angeles	*17,000
Belridge Oil Co., North Belridge, Kern	*90,000
Brea Canyon Oil Co., Brea-Olinda, Orange	10,000
Coline Gasoline Co., Rincon, Ventura	*50,000
Continental Oil Co., Ventura, Ventura	*45,500
Cowan Oil & Ref. Co., Rosecrans, Los Angeles	10,000
Fullerton Oil Co., Huntington Beach, Orange	40,000
General Petroleum Corp.:	
Athens, Los Angeles (fractionating plant)	*280,000
Helm, Riverdale, Lanare, Fresno	*60,000
Santa Fe Springs, Los Angeles	50,000
Ventura, Ventura	40,000
Wilmington, Los Angeles	75,000
Honolulu Oil Corp.:	
Buena Vista Hills, Kern	*30,000
Cymric, Kern	*45,000
Inglewood Gasoline Corp., Potrero, Los Angeles	5,500
Lomita Gasoline Co., Signal Hill, Los Angeles	*130,000
Magruder, P. S., Operator:	
Kettleman Hills, Kings, (Huffman plant)	*110,000
Kettleman Hills, Kings (Western States gasoline plant)	*145,000
Naval Pet. Reserve No. 1 (Unit Operation Standard Oil Co. of Calif.), Elk Hills, Kern	5,000
Norwalk Co.:	
Maricopa-Sunset, Kern	17,000
Santa Fe Springs, Los Angeles	*16,500
Rice Ranch Oil Co., Orcutt, Santa Barbara	2,800
Richfield Oil Corp.:	
North Coles Levee, Kern	*142,000
Russell Ranch, San Luis Obispo	*111,000
South Cuyama, Santa Barbara	*146,000
Shell Oil Co.:	
Brea, Orange	26,000
Capitan, Santa Barbara	*3,600
Dominguez, Los Angeles	12,000
Long Beach, Los Angeles	37,000
Santa Maria, Santa Barbara	1,500
Ten Section, Kern	*110,000
Ventura, Ventura	200,000
Signal Oil & Gas Co.:	
Elwood, Santa Barbara	*25,000
Huntington Beach, Orange	*175,000
Signal Hill, Los Angeles	*100,000
Standard Oil Co. of California:	
Greeley, Kern	*60,000
Huntington Beach, Orange	*54,000
Inglewood, Los Angeles	35,000
(11-P) Kettleman Hills, Kings	50,000
(3-P) Kettleman Hills, Kings	*228,000
(33-J) Kettleman Hills, Fresno	50,000
Lost Hills, Kern	4,000
(1-C) Midway, Kern	*60,000
(7-D) Midway, Kern	20,000
(29-G) Midway, Kern	20,000
Murphy-Coyote, Orange	*120,000
(32-Z) Mountain View, Kern	16,000
Northeast Coalinga, Fresno	35,000
Santa Fe Springs, Los Angeles	40,000
Seal Beach, Los Angeles	30,000
Torrance, Los Angeles	12,000
Sunray Oil Corp., Newhall, Los Angeles	*50,000
Superior Oil Corp., Rio Bravo, Kern	*100,000
Texas Co., The:	
Santa Fe Springs, Los Angeles	*37,100
Signal Hill, Los Angeles	*74,000
Shiells Canyon, Ventura	*50,000
Tide Water Associated Oil Co., Ventura Ave., Ventura	*150,000
Union Oil Co.:	
Brea, Orange	38,000
Coalinga Nose, Fresno	*41,000
Del Valle, Ventura	*57,000
Dominguez, Los Angeles	56,000
Orcutt, Santa Barbara	*30,000
Playa del Rey, Los Angeles	6,000
Richfield, Orange	14,000
Rosecrans, Los Angeles	27,000
Santa Fe Springs, Los Angeles	58,000
Santa Maria, Santa Barbara	*41,000
West Coast Refining Co., Richfield, Orange	50,000
Wilmington Gasoline Co., Terminal Island, Los Angeles	*105,000
Total	4,181,500

*Includes L.P.G.

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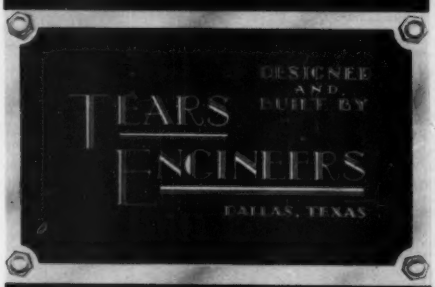


The Mark of a Job Well Done

NATURAL-GASOLINE-PLANT SURVEY

COLORADO

Company, field or plant, and county—	Approx. prod (gal. per day)
California Co., The, Rangely, Rio Blanco	*68,000

*Includes L.P.G.

ILLINOIS

Arkansas Fuel Oil Co., Robinson, Crawford	500
Brenneman & MacDowell, Condry, Crawford (2 plants)	1,250
Carter Oil Co., Louden, Lafayette	*74,000
Engle Petroleum, Inc., Benton, Franklin	*10,000
Texas Co., The:	
Hoodville, Hamilton	*77,000
Salem, Marion	*168,300
Warren Petroleum Corp.:	
Grossville, White	*60,000
Salem, Marion	*80,000
Total	451,050

*Includes L.P.G.

KANSAS

Cities Service Oil Co. (Del.):	
Main Line, Sedgwick	*104,000
Main Line, Cowley	*24,000
Burrton, Reno	*20,000
Colorado Interstate Gas Co., Hugoton, Kearny	40,000
Dearfield Petroleum, Inc., Hugoton, Kearny	*25,000
Flynn Oil Co., Otis, Rush	*530
Kansas P. & L. Co., Medicine Lodge, Barber	30,000
Magnolia Petroleum Co., Hickok, Grant	*78,000
Northern Natural Gas Co., Hugoton, Seward	65,000
Panhandle Eastern Pipe Line Co., Hugoton, Seward	*110,000
Skelly Oil Co., Cunningham, Kingman	*15,000
Stanolind Oil & Gas Co., Hugoton, Grant	*283,000
Sunray Oil Corp., Rainbow Bend, Cowley	*3,000
Texas Co., The, Atlanta, Cowley	*7,400
Total	804,930

*Includes L.P.G.

KENTUCKY

Ashland Oil & Refining Co., Fixer, Lee	2,000
Kentucky-West Virginia Gas Co., E. Ky., Boyd	8,000
Tennessee Gas Transmission Corp., Gabe (Main Line)	*380,000
United Fuel Gas Co.:	
Leach plant, Boyd	*55,000
Warfield plant, Martin	*40,000
Total	485,000

*Includes L.P.G.

LOUISIANA

Company, field or plant, and parish—	
Anchor Gasoline Corp.:	
Eola, Avoyelles	*40,000
Cheneyville, Rapides	6,000
Pine Prairie, Evangeline	*18,000
North Tepetate	15,000
Anse La Butte Gasoline Co., Anse La Butte, St. Martin	*12,000
Arkansas Fuel Oil Co.:	
Bisteneau, Webster	*33,000
Langston, Claiborne	5,000
North Ruston, Lincoln	*40,000
Rodessa, Caddo	*13,500
Shreveport, Caddo	*11,900
Sligo, Bossier	*18,500
Atlantic Refining Co., Neale, Beauregard	*82,740
California Co., Hico Knowles, Lincoln	*142,800
Carter Oil Co., Stiles, Caddo	*5,000
Claiborne Gasoline Co., Lisbon, Claiborne	*150,000
Coltexo Corp., Rodessa, Caddo	*50,000
Continental Oil Co.:	
Gillis, Calcasieu	12,000
Tepetate, Acadia	12,000
Ville Platte, Evangeline	*100,000
Great National Oil Corp. of Louisiana, Ida, Caddo	35,000
Gulf Refining Co., Homer, Claiborne	10,000
Humble Oil & Refining Co., St. Landry†	*126,000
Hunt Oil Co., Lisbon, Claiborne	*70,000
Magnolia Petroleum Co., Mamou, Evangeline	*25,000
Ohio Oil Co., Hayesville, Claiborne	*3,000
Shell Oil Co., Iowa, Calcasieu	5,000
Stanolind Oil & Gas Co., Pine Island, Caddo	4,000
Sun Oil Co., Delhi, Richland	*82,000
Sunray Oil Corp., West Tepetate, Jefferson Davis	*32,000
Texas Co., The, Lafitte, Jefferson	14,000
United Gas Pipe Line Co.:	
Koran plant, Webster	*22,000
Myrtis plant, Caddo	*54,000
Sugar Creek, Claiborne	*23,000
Total	1,272,440

*Includes L.P.G. †Under construction. ‡On gas line.

MICHIGAN

Company, field or plant, and county—	Approx. prod (gal. per day)
Sun Oil Co., Kimball Lake, Newaygo*	5,000

*Compressor station.

MISSISSIPPI

California Co., Brookhaven, Lincoln	*19,950

*Includes L.P.G.

MONTANA

Union Oil Co. of California, Cut Bank, Glacier	*30,000

*Includes L.P.G.

NEBRASKA

Ohio Oil Co., Huntsman, Cheyenne	*36,000

*Includes L.P.G.

NEW MEXICO

El Paso Natural Gas Co.:	
Jal, Lea Plant 1	*33,100
Jal, Lea Plants 2 and 3	*89,500
San Juan County	*54,300
Frontier Natural Gasoline Co., Grayburg-Jackson, Eddy	*30,000
Gulf Oil Corp., Drinkard, Lea	*141,000
Maljamar Coop., Maljamar, Lea	*24,000
Phillips Petroleum Co.:	
Eunice, Lea	*102,000
Hobbs, Lee, Lea	*79,000
Skelly Oil Co., Eunice, Lea (2 plants)	*125,000
Southern Union Gas Co., Fulcher-Kutz, San Juan	*21,000
Valley Gas Corp., Loco Hills, Eddy	*12,000
Warren Petroleum Corp., Monument, Lea	*75,000
Total	785,900

*Includes L.P.G.

OHIO

East Ohio Gas Co., Cuyahoga County	2,550
Ohio Fuel Gas Co.:	
Northern Medina	4,000
Sugar Grove, Fairfield	6,000
River Gas Co., Ludlow, Monroe	4,000
Total	16,550

OKLAHOMA

Apache Gas Co.:	
Apache, Caddo	*10,000
W. Brock, Carter	*15,000
Barksdale Co., Barksdale, Hughes	500
Carter Oil Co.:	
Fitts, Pontotoc	*50,000
Seminole, Seminole	*85,600
Cromwell	*50,000
Cities Service Oil Co. (Del.):	
Oklahoma City, Oklahoma	*14,000
Guymon, Texas(Main Line)	20,000
Tallant, Osage, (Main Line)	5,000
Continental Oil Co.:	
Billings, Noble	*13,000
Tonkawa, Kay	10,000
Devonian Oil Co., Kellyville, Creek	*20,000
Eason Oil Co., Crescent, Logan	*43,000
Frame Natural Gasoline Co., Pawnee	2,000
Grimes Gasoline Co.:	
Wetumka, Hughes	*15,000
Coon Creek, Oklahoma	*10,000
Grimes, Chas. W. and Otha H.:	
Okemah, Okfuskee	1,000
Weleetka, Okfuskee	*12,000
Grimes, Otha H., Pauls Valley, Garvin	*20,000
Otha H. Grimes and Roy O. Neal, Drumright, Creek	3,500
Gulf Oil Corp.:	
Kiefer, Creek	*28,000
Mission, Seminole	*7,000
Keener Oil Co., Custer	*45,000
Kerr-McGee Oil Industries, Inc.: (operator)	
Fitts, Pontotoc	*30,000
Happy Valley, Lincoln	*20,000
Milfay, Creek	*30,000
Lone Star Gas Co.:	
Hollis, Harmon	*20,000
Katie, Garvin	20,000

OKLAHOMA (Continued)

Company, field or plant, and county	Approx. prod (gal. per day)
Magnolia Petroleum Co.:	
Davenport, Lincoln	*5,000
Graham, Carter	*22,000
St. Louis, Pottawatomie	*16,000
Sholem Alechem, Stephens	*90,000
Mid-Continent Petroleum Corp.:	
Cromwell, Seminole	*21,600
Sawyer, Creek	*9,000
Stillwater, Payne	*5,100
Prague, Okfuskee	*2,500
Moore, Clevelond	*10,300
Neal Gasoline Co., Osage, Osage	5,200
Panoma Corp., Guymon-Hugoton, Texas	*116,500
Patton & Swab, Inc., Edmond	*6,000
Phillips Petroleum Co.:	
Burbank (Denoya), Osage	*36,000
Burbank (Reserve), Osage	*14,000
Edmond, Oklahoma	*158,000
Edmond (Huntington), Oklahoma	*72,000
Oklahoma City, Oklahoma	*50,000
Wewoka, Seminole	*17,000
Pioneer Corp., Bixby, Tulsa	1,000
Pure Oil Co., Glenn Pool, Creek	6,000
Shell Oil Co., Hewitt, Carter	*24,000
Sinclair Oil & Gas Co.:	
Covington (6), Garfield	*90,000
Drumright (2), Creek	70,000
Seminole (13), Seminole	*210,000
Seminole (12), Seminole	50,000
Shamrock (3), Creek	25,000
St. Louis (14), Pottawatomie	30,000
Skelly Oil Co.:	
Burbank, Osage (3 plants)	*60,000
Velma, Stephens	*90,000
Sunray Oil Corp.:	
Avant, Osage	2,000
Seminole-Earlsboro, Pottawatomie	*28,000
Texas Co., The:	
Davenport, Lincoln	*25,200
Z. More, Creek	6,000
Blackbird, Osage	*3,700
Universal Gasoline Co., Aylesworth, Marshall	*5,800
Warren Petroleum Corp.:	
Madill, Marshall	*50,000
Maud, Pottawatomie	*25,000
Mayesville, Garvin	*385,000
Ringwood, Major	*75,000
Total	2,517,500

*Includes L.P.G.

PENNSYLVANIA

Company, field or plant, and county	Approx. prod (gal. per day)
Bayliss & Bayliss, Titusville	10,000
Clinger Oil & Gas Co.:	
Tidioute, Fagundus	1,000
Tidioute, Hastings	1,000
Crawford & Gregory, Venango County	140
Ellenburger, W. J., & Sons, Karns City	300
Equitable Gas Co., Rogersville, Greene	10,000
Haskell, Roth & Bayliss, Tidioute, Warren	10,000
Mars Co.:	
Lewis Run, McKean	6,500
Pinegrove, Venango	4,000
Van, Venango	*9,500
Pennsylvania Oil Co., Sheffield, Warren	10,000
Peoples Natural Gas Co., Brave, Greene	20,000
Quaker State Oil Refining Co., McDonald, Allegheny	2,500
Surety Oil Co.:	
Tiona, Warren	500
Titusville	1,000
Trueman's Forrest	150
Warner-Caldwell Oil Co., Titusville, Crawford	1,000
Total	87,590

*Includes L.P.G.

TEXAS

Company, field or plant, and county	Approx. prod (gal. per day)
Abercrombie Co., J. S., Old Ocean, Brazoria	*320,000
Amarillo Oil Co., Panhandle, Potter	*13,500
American Republics Corp.:	
Silsbee, Hardin	*110,000
Joe's Lake, Tyler	*12,000
Anchor Gasoline Corp., Tex-Harvey, Midland	*100,000
Anzak Oil Corp., Overall, Coleman	200
Arkansas Fuel Oil Co.:	
Carthage, Panola	*39,000
Panola, Panola	*125,000
East Texas, Gregg	*105,000
Smithland, Marion	8,000
Rodessa (Jefferson area), Marion	*30,000
Waskom, Harrison	*157,000
Atlantic Refining Co., Block 31, Crane	*21,000
Barnhart Hydrocarbon Corp., Barnhart, Reagan	*90,000
Bennett O. & R. Co. of Texas, Mission River, Refugio	15,000
Breckenridge Gasoline Co.:	
Eliasville, Stephens	*18,000
Rodessa, Gass	*30,000
Cabot Carbon Co.:	
Estes, Winkler	*35,000
Walton, Winkler	*54,000
Keystone, Winkler	20,000
Canadian River Gas Co., West Panhandle, Moore	50,000
Carthage Corp., Carthage, Panola	*417,200
Caska Corp., Quitman, Wood	*15,000
Chicago Corp., The, Carthage, Panola	*215,000
Cities Service Oil Co. (Del.):	
Chico, Wise	*55,000
Pampa, Gray	*50,000
Colorado Interstate Gas Co., W. Panhandle, Moore	35,000
Coltexo Corp., Panhandle, Gray	50,000
Columbian Gasoline Corp., Wheeler, Wheeler	25,000
Consolidated Gasoline Co., Cisco, Eastland	8,000
Continental Oil Co.:	
K.M.A., Wichita	140,000
Rincon, Starr	31,500
Todd Ranch, Crockett	*85,000
Slick-Wilcox, De Witt	1,600
Del Rey Petroleum Co., Chesterville, Colorado	*60,000
Duval Gasoline Co.:	
Benavides, Duval	2,100
Benavides, Duval	*8,500
El Paso Natural Gas Co., Sealy-Smith, Ward	*47,100
E. Texas Prod. Gas., Chapel Hill, Smith	†20,000
Fullerton Oil Co., Fullerton, Andrews	120,000
Gregg-Tex Gasoline Corp., East Texas, Gregg	*135,000
Grimes, Otha H., Eskota, Fisher	*8,000
Gulf Oil Corp.:	
East Texas, Gregg	*168,000
East Texas, Rusk	*42,000
North Ward-Estes, Crane	24,000
San Hills, etc., Crane	*91,000
Henderson Trust No. 2, W. Panhandle, Hutchinson	40,000
Hilander Gasoline Co., Rogers, Montague	12,000
Huber, J. M., Corp., Panhandle, Hutchinson	*32,000
Humble Oil & Refining Co.:	
Anahuac, Chambers	46,000
Clear Lake, Harris	*68,000
Conroe, Montgomery	*100,000
East Texas, Rusk	*281,000
Flour Bluff, Nueces	8,000
Heyser, Calhoun	8,400
Jourdanton, Atascosa	*50,000
Pickton, Hopkins	*48,000
Tomball, Harris	38,000
Tom O'Connor, Refugio	*60,000
H. L. Hunt, Harleton, Harris	*50,000
Ibex Co., The, Ibex, Shackelford	*9,000
La Gloria Corp., La Gloria, Jim Wells	*50,000
Lion Oil Co., Diamond M, Sharon Ridge, Scurry	*315,500
Lone Star Gas Co.:	
Palo Pinto, (Main Line)	*25,000
Eastland (Main Line)	10,000
Henderson (Main Line)	*50,000
Lone Star Producing Co.:	
Brooks, Stephens	25,000
Eastland (fractionating plant)	*90,000
Eastland	40,000
Stephens	25,000
Lyman, C. V., Gasoline Co., Emperor, Winkler	*10,000
Magnolia Petroleum Co.:	
Burkburnett, Wichita	*6,000
Desdemona, Eastland	*11,000
Electra, Wilbarger	*6,000
Kermit, Winkler	*18,000
Olden, Eastland	*4,500
Sabine, Gregg	*111,000
Vanderbilt, Jackson	*43,000
Manning, Fred M., McKnight, Throckmorton	†6,000
McCarthy Chemical Co.:	
Stonewall-Jackson Pasture, Jefferson	*106,000
Stonewall-Jackson Pasture, Jefferson	*275,000
Mid-Co Gasoline Co., Cayuga, Henderson	*5,000
Midland Gasoline Co., Conroe, Montgomery	*90,000
Moncrief, W. A., & Sons, Wichita-K.M.A.	*4,000
Nash Gasoline Co.:	
James, Young	*4,000
South Bend, Young	*8,000
Natural Gasoline Corp., Hawkins, Wood	*100,000
Natural Gas Pipe Line Co. of America:	
Panhandle, Hutchinson	105,000
Panhandle, Moore	85,000
Nine Oaks Gasoline Co., Gladewater, Gregg	700
Nueces Corp., Agua Dulce, Nueces	240
Odessa Natural Gasoline Co., Foster, Ector	*60,000

make your own comparison...

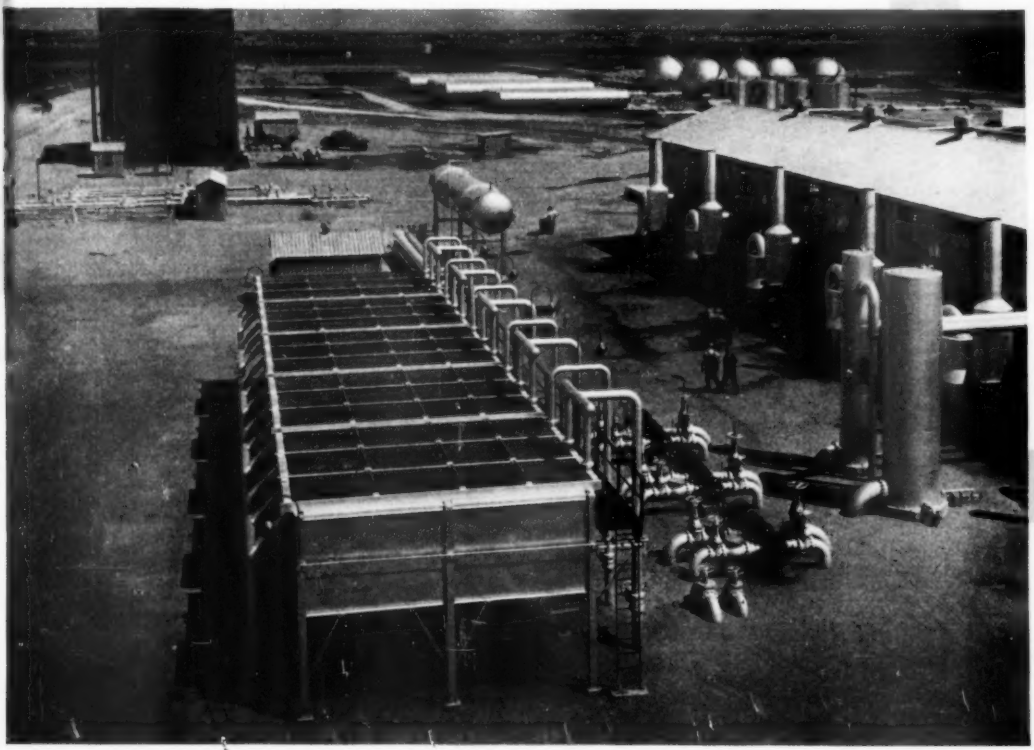
a Fluor-GR Fin-Fan

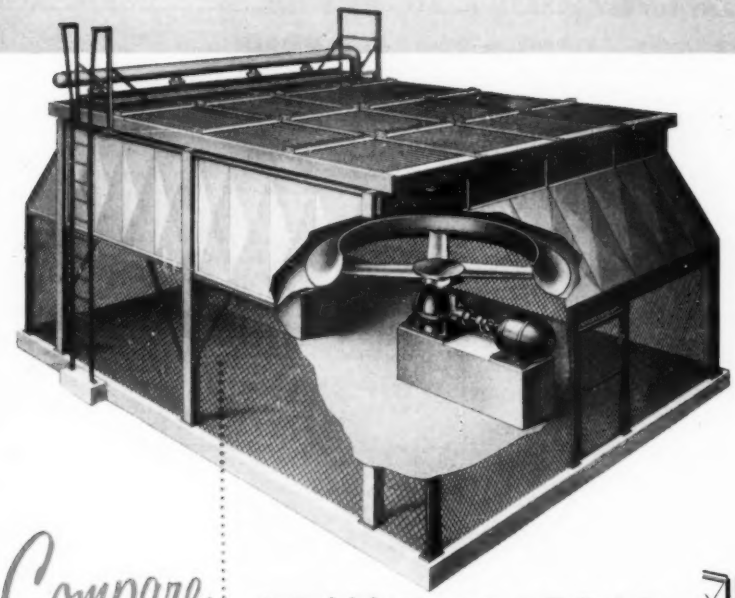
against any other air-cooled heat exchanger

When considering air-cooled heat exchanger equipment, compare the advantages of a Fluor-GR Fin-Fan. Make comparisons of structural simplicity and flexibility. Compare the exclusive features of the K-Fin section, the rugged yet precision design of all mechanical equipment. Check *proven performance* in such varied services as petroleum refineries, light hydrocarbon processing plants, chemical processing plants, and power and industrial plants.

The Fluor-GR Fin-Fan was *pioneered* by The Fluor Corporation and the Griscom-Russell Company. It was the *first* of this type heat exchanger to be developed for industry. Fluor, with its wide experience in the theory, design, and fabrication of air-moving systems, and Griscom-Russell, with its long experience in heat transfer, *continue* to lead in the development and refinement of air-cooled heat exchanger equipment.

Before you buy or specify, compare the Fluor-GR Fin-Fan. A Fin-Fan provides more exclusive design features—features that add up to *efficient, dependable* performance —than any other make of air-cooled heat exchanger. Write for Fluor Bulletin No. FF-8501.



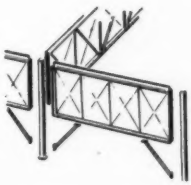


Compare

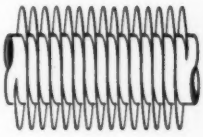
Compare

Compare

structural design – Structurally, the Fin-Fan is the ultimate in simplicity and flexibility. Its "truss-type" design provides a rugged, vibrationless unit, free of extraneous parts. Uniform prefabrication of parts, with bolt holes and orientation *incorporated* in basic design, permits easy extension without shut-down of existing units!



K-Fin features – The K-Fin has exclusive features for elevated temperature applications. These patented features include: (1) attachment of helical-fins by first "plowing" a groove in each tube and then "knurling" the fins permanently in place; and (2), the "Bentube" principle which permits extreme expansion and contraction *without* damage to tubes or header connections.



mechanical equipment – Fluor mechanical equipment is ruggedly designed to meet specific heat transfer requirements. 4 basic gear units cover 4 different and distinct horsepower ranges. This, coupled with a choice of fan assemblies ranging from 8′ to 20′ in diameter, with 4 or 6 blades per fan unit, enables the *proper* combination of gears and fans to effect optimum efficiency.

Compare

proven performance . . .

More Fluor-GR Fin-Fan Air-Cooled Heat Exchangers are in service throughout the continental United States and in countries abroad than any other make. More Fluor-GR Fin-Fan installations are the result of repeat orders than any other type. Check with your nearest Fluor Representative for the Fin-Fan's outstanding record of proven performance – in services and duties similar to your own!

FLUOR

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THE FLUOR CORPORATION, LTD., 2500 S. ATLANTIC BLVD., LOS ANGELES 22, CALIF.
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Represented in the Sterling areas by:
Head Wrightson Processes Ltd., Teesdale House, Baltic Street, London, E.C.1., England

SINCE 1890

TEXAS (Continued)

Company, field or plant, and county	Approx. prod (gal. per day)
Padre Petroleum Co., Rising Star, Brown	*10,000
Panhandle Producing and Refining Co., Bryson, Jack	300
Panoma Corp., W. Panhandle, Carson	*131,000
Parade Co., East Texas, Rusk	*175,000
Perkins Co., Burkburnett, Wichita	2,000
Prewitt, P. H., Joaquin, Shelby	2,000
(Property sold to Southern Nat. Gas Co.)	
Phillips Petroleum Co.:	
Bowers, Gray	*27,000
Canadian, Hutchinson	*37,000
McElroy, Crane	*60,000
Dumas, Moore	*101,000
Fullerton, Andrews	*126,000
Goldsmith, Ector	*228,000
Gray, Gray	*81,000
Hansford, Hansford	*83,000
Judkins-Harper, Ector	*37,000
K.M.A., Wichita	*30,000
Lefors, Gray	*33,000
North, Gray	*29,000
Pampa, Gray	*47,000
Pantex, Hutchinson	*26,000
Rock Creek, Hutchinson	*150,000
Sanford, Hutchinson	*120,000
Seminole, Gaines	*42,000
Sherman, Hansford	*173,000
Sneed, Moore	*153,000
Chocolate Bayou, Brazoria	*174,000
Pioneer Gasoline Co., Pioneer, Eastland	*5,000
Plymouth Oil Co.:	
Benedum, Upton	*280,000
Plymouth, San Patricio	*90,000
Portland Gasoline Co., Panhandle, Gray	*55,000
Pure Oil Co.:	
Dollarhide, Andrews	*175,000
Van, Van Zandt	*75,000
Reno Oil Co., Reno-Strawn, Archer	4,500
Sid Richardson Gasoline Co., Keystone, Winkler	*150,000
Roeser & Pendleton:	
Plant 1, Shackelford	5,000
Plant 4, Anderson	2,000
Rudco Oil &Gas Co., Rising Star, Brown	*2,250
St. Marys Oil & Gas Co.:	
Colony, Callahan	34,000
Moran, Shackelford	6,000
Shamrock Oil & Gas Corp., Panhandle, Moore	*400,000
Shell Oil Co.:	
Panhandle, Carson	25,000
Panhandle, Gray No. 15	15,000
Provident City, Lavaca	105,000
T-X-L, Ector	*370,000
Wasson, Yoakum	364,000
Sinclair Oil & Gas Co.:	
Longview (18), Gregg	*225,000
Taft (20), San Patricio	*30,000
Troup (19), Rusk-Smith	*100,000
Troup (21), Rusk	*130,000
Skelly Oil Co.:	
Burkburnett, Witchita	3,500
Carson, Gray, and Hutchinson counties (2 plants)	*260,000
Southern Minerals Corp.:	
Saxet, Nueces	*15,000
Stratton, Nueces	*50,000
Southern Production Co., Pledger, Brazoria	*20,000
Standard Oil Co. of Texas:	
Sivalls Bend, Cooke	*21,000
Scurry, North Snyder	*126,000
Stanolind Oil & Gas Co.:	
Hastings, Brazoria	*60,000
La Rosa, Refugio	*50,000
Levelland, Hockley	*134,000
Luby, Nueces	*55,000
North Cowden, Ector	*150,000
Slaughter, Hockley	*250,000
South Fullerton, Andrews	*295,000
Sun Oil Co.:	
Jameson, Coke	*48,000
Sun, Starr	*102,000
Sunray Oil Corp., Snyder, Scurry	*525,000
Texas Co., The, (Operator):	
Chalk Hill, Archer	*12,350
Texas Co., The, Electra, Wichita	*23,000
Texas Gas Products Corp., Benedum, Upton	*300,000
Texas Natural Gasoline Corp.:	
Santa Rosa, Pecos	*30,000
Walnut Bend, Cooke	*50,000
Wimberly, Jones	*100,000
Texas-Pacific Coal & Oil Co., Caddo, Stephens	*19,000
Tex-Harvey Gasoline Plant, Inc., Tex-Harvey, Midland	*200,000
Tide Water Associated Oil Co.:	
Long Lake, Anderson	*10,000
Cayuga, Anderson	*30,000
Sublime, Colorado	21,000
South Sinton, San Patricio	1,300
Yoward, Bee	10,000
United Gas Pipe Line Co.:	
Agua Dulce, Nueces	*49,000
Carthage, Panola	*400,000
Karnes City, Karnes	*50,000
Waggoner, W. T., estate, Waggoner, Wilbarger	7,000
Warren Petroleum Corp.:	
Breckenridge, Stephens	*60,000
Fairbanks, Harris	*40,000
East Texas, Gregg	*160,000
Holliday, Archer	*90,000
McLean, Wheeler	*45,000
Madden, Wichita	*45,000
West Gasoline Co., Hul, Liberty	12,000
West Texas Gasoline Co., W. Panhandle, Potter	20,000
Total	14,471,240

*Includes L.P.G. (Estimated

WEST VIRGINIA

Company, field or plant, and county	Approx. prod (gal. per day)
Carnegie Natural Gas Co. (entire holdings), Wetzel Co.	*750
Falling Rock Channel Coal Co., Falling Rock	3,000
Hope Natural Gas Co.:	
Cornwell, Kanawha	20,000
Hastings, Wetzel	*200,000
Kennedy, Lewis	30,000
Waverly, Wood	20,000
Manufacturers Light & Heat Co.:	
Reader, Wetzel	10,000
Proctor, Marshall	3,000
Owens, Libby-Owens Gas Dept., Kanawha County	10,000
Pure Oil Co., Cabin Creek, Kanawha	*7,000
Quaker State Oil Refining Corp., Wetzel County (2 plants)	8,750
South Penn Natural Gas Co.:	
Bennett, Gilmer	500
Blackshere, Marion	800
Broadwater, Tyler	300
Clay, Clay	2,500
Coldwater, Harrison	300
Copley, Lewis	800
Edgell, Roane	1,200
Fairview, Monongalia	3,000
Griffith, Lincoln	2,000
Hartley-Stephens, Ritchie	2,600
Liverpool, Jackson	500
Lynch, Harrison	3,500
McElroy, Tyler	500
Metz, Marion	1,200
Morgan, Wetzel	3,000
Oil Siding, Kanawha	500
Pine Grove, Wetzel	3,500
Prutny, Ritchie	300
Rock Creek, Roane	1,200
Seckman, Tyler	500
Shinnston, Harrison	500
Stringtown, Tyler	3,000
Sweeney, Tyler	500
Tanner, Gilmer	3,000
Victor, Kanawha	3,500
Wood, Elk Fork, Eddy, Tyler	1,000
United Fuel Gas Co.:	
Cobb plant, Kanawha	40,000
Elk plant, Kanawha	*20,000
Ferrell plant, Kanawha	3,500
Hubball plant, Lincoln	*40,000
Ona plant, Cabell	18,000
Sandyville plant, Jackson	*30,000
Total	504,200

*Includes L.P.G

WYOMINGG

Company, field or plant, and county	Approx. prod (gal. per day)
Continental Oil Co., Lance Creek, Niobrara	*65,000
Mountain Fuel Supply Co., Church Buttes, Uinta	21,000
Northern Utilities Co., Sand Draw, Fremont	3,500
Ohio Oil Co., The:	
Grass Creek, Hot Springs	3,600
Rock River, Albany	*7,500
Pure Oil Co., Worland, Washakie	*50,000
Sinclair Oil & Gas Co., Lost Soldier, Sweetwater	15,000
Stanolind Oil & Gas Co.:	
Salt Creek, Natrona	*93,000
Elk Basin, Park	*56,000
Total	314,600

*Includes L.P.G

Survey of Cycling Plants

Compiled by The Oil and Gas Journal's Statistical Department

ARKANSAS

Company, field or plant, and county	Approx. prod (gal. per day)
McKamie Gas Cleaning Co., McKamie, Lafayette	*58,500

*Includes L.P.G.

CALIFORNIA

Company, field or plant, and county	Approx. prod (gal. per day)
Ohio Oil Co. (Operator), South Coles Levee, Kern	*284,000
Western Gulf Oil Co. (Operator), Paloma, Kern	*412,000
Total	696,000

*Includes L.P.G.

COLORADO

Company, field or plant, and county	Approx. prod (gal. per day)
Continental Oil Co., McCallum, Jackson	27,000

LOUISIANA

Company, field or plant, and county	Approx. prod (gal. per day)
Acadia Corp., Egan, Acadia	*128,000
California Co., The, Lake St. John, Tensas	*175,140
Cotton Valley Operators Comm., Cotton Valley, Webster	*420,000
Haynesville Operators Comm., Haynesville, Claiborne	*65,000
Southwest-Feazel, Dubach, Lincoln	*100,000
Stanolind Oil & Gas Co., South Jennings, Jefferson Davis	*58,000
Sunray Oil Corp., Benton, Bossier	*210,000
Texas Co., The, Operator, Erath, Vermilion	*672,000
Bateman Lake, St. Mary	*87,350
Total	1,915,490

*Includes L.P.G.

MISSISSIPPI

Company, field or plant, and county	Approx. prod (gal. per day)
California Co., The, Cranfield, Adams	*107,100

*Includes L.P.G.

OKLAHOMA

Company, field or plant, and county	Approx. prod (gal. per day)
Magnolia Petroleum Co., Chitwood, Grady	*57,000
Shell Oil Co., Elk City	*275,000
Total	332,000

*Includes L.P.G.

TEXAS

Company, field or plant, and county	Approx. prod (gal. per day)
Agua Dulce, Co., Agua Dulce, Nueces	*40,000
American Liberty Oil Co., Blessing, Matagorda	25,000
American Republics, Silsbee, Hardin	*135,000
Anco Gas Corp., Long Lake, Anderson	15,000
Atlantic Refining Co., Crane	*21,000
Big Lake Oil Co., Big Lake, Reagan	80,000
Chicago Corp., The:	
Stratton-Agua Dulce, Nueces (Gulf Plains)	*145,000
Stratton-Agua Dulce, Nueces (Coastal plant)	*145,000
Stratton-Agua Dulce, Nueces (Wardner plant)	*176,400
Distillate Prod. Corp., North Houston, Harris	*51,500
Federal O. & G. Industries, Inc., Joyce Richardson, Harris	8,400
Francitas Gas Co., Francitas, Jackson	*40,000
Gasoline Production Corp., Bee	65,000
Geier-Jackson, Inc., Grapeland, Houston	*80,000
Gilliland Oil Co., Inc., Agua Dulce, Nueces	*40,000
Gray-Wolfe Co., Pinehurst, Montgomery	20,000
Harrell, H. M., Ehrhardt, Harris	40,000
Humble Oil & Refining Co., Katy, Waller	*958,000
La Gloria Corp., La Gloria, Jim Wells and Brooks	*†330,600
Lone Star Producing Co.:	
Opelika, Henderson	*80,000
Carthage, Panola	100,000
Chapel Hill, Smith	*120,000
Magnolia Petroleum Co., Seeligson, Jim Wells	*500,000
Plomo Co., Brayton, Nueces	*65,000
Roeser & Pendleton, Cayuga, Anderson	2,000
Shell Oil Co., Sheridan, Colorado	*200,000
Standard Oil Co. of Texas, Duval	73,500
Stanolind Oil & Gas Co., Burnell-North Pettus, Bee	*287,000
Superior Oil Co., Lake Creek, Montgomery (2 plants)	*300,000
Taylor Refining Co., McAllen, Hidalgo	*190,400
Tide Water Associated Oil Co.:	
Cayuga, Anderson	30,000
Long Lake, Anderson	*40,000
Trinity Gas Corp., Sejita, Duval	*76,000
Wescol Oil & Gas Co., Nordheim, De Witt	†100,000
Western Natural Gas Co., San Salvador, Hidalgo	96,600
Total	4,676,400

*Includes L.P.G. †Also includes motor fuel, kerosine, mineral oil and residuum. ‡Condensate production included.

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Clean Tanks	Unplug Drain Lines	Pump out Cellars	Puddle Trenches
Agitate Mud	Clean Cooling Tower Basins	Oil Roads	Unplug Lines
Transfer acids, acid sludge and caustics	Clean Separator Boxes	Spray Weeds	Bell-hole

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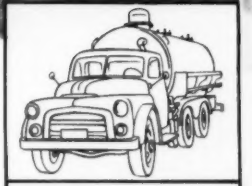
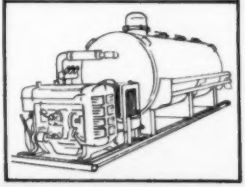


• Top: 40 bbl. unit on small truck



• Below: 60 bbl. unit on skids

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Survey of Processing-Plant Projects

Compiled by The Oil and Gas Journal's Statistical Department

LIQUID capacity of the various natural-gas processing-plant projects under way, planned, and authorized in the early months of this year, is estimated to exceed 1.8 million gallons daily. Most of this capacity, around 70 per cent, is that of new plants, many of which are now under construction. Increases to existing plants run to about 600,000 gal. daily.

So far this year the combined capacity of all expansion projects, reported to The Oil and Gas Journal by operating companies, falls below that needed to meet projected demand requirements for early 1953. This slack may be taken up in the latter part of this quarter and in the next quarter. The heavy demand for the L.P.G. range of products by the petrochemical industry is resulting in a large number of modernization projects involving natural-gas processing plants.

For the natural-gas processing industry to hold the expansion pattern of the last few years, field processing-plant capacity will have to be upped by about 6,000,000 gal. daily by the end of 1953. Based on the Journal's current survey of natural-gas processing-plant construction projects, about 4,000,000 gal. daily of additional capacity is needed to reach the projected capacity figure for the beginning of 1954. To meet this projected 1954 capacity figure the industry will have to build 25 large-capacity plants in addition to the 17 major new-plant projects currently building, authorized, and planned.

Natural-Gas Processing-Plant Building Projects

Company, location, and type of project—	Capacity rating	Status	Comp. schedule	Contractors
Amarillo Oil Co., Amarillo, Tex.:				
Move gasoline plant		Building	1952	
American Republics Corp., Hardin County, Texas:				
Remote absorber, cu. ft. per day	30,000,000	Building	1952	
Anchor Gasoline Corp., North Tepetate, La.:				
New gasoline plant, gal. per day	15,000	Building	Mid '52	
Arkansas Fuel Oil Co., Haughton, La.:				
Plant increase, cu. ft. per day	60,000,000	Building	Late '52	
Arkansas Fuel Oil Co., Heflin, La.:				
Plant increase, cu. ft. per day	60,000,000	Building	Late '52	
Arkansas Fuel Oil Co., Magnolia, Ark.:				
Increase propane recovery, cu. ft. per day	100,000,000	Building	Late '52	
Atlantic Refining Co., Crane County, Texas:				
Increase plant capacity		Planned		
Bennett Oil & Refining Co. of Texas, Refugio, Tex.:				
Increase compressor capacity, cu. ft. per day	2,500,000	Planned	1952	
Carbide & Carbon Chemicals Div., Texas City, Tex.:				
Petrochemical plant		Planned		
Cities Service Oil Co. (Del.), Blackwell, Okla.:				
New natural-gasoline plant, gal. per day	200,000	Authorized		
Colorado Interstate Gas Co., Dumas, Tex.:				
New gasoline plant		Planned		
Del Rey Petroleum Co., Eagle Lake, Tex.:				
Plant increase, cu. ft. per day	40,000,000	Building	1952	O. L. Olson Co.
Delta Chemical Co., Pointe a la Hache, La.:				
Petrochemical plant		Planned		
El Paso Natural Gas Co., Lea County, New Mexico:				
Purification and dehydration plant, cu. ft. per day	80,000,000	Building	1952	
New gasoline plant, cu. ft. per day	85,000,000	Building	1952	Fluor Corp.
New gasoline plant, gal. per day	142,000	Planned	1952	
El Paso Natural Gas Co., San Juan County, New Mexico:				
New gasoline plant, gal. per day	192,000	Planned	1952	
El Paso Natural Gas Co., Midland County, Texas:				
Purification and dehydration plant, cu. ft. per day	10,000,000	Building	1952	
General Crude Oil Co., Kent County, Texas:				
Extraction plant		Planned		
General Petroleum Corp., Manderson field, Wyoming:				
Sulfur plant, tons per day	50	Authorized		
Gregg-Tex Gasoline Corp., Longview, Tex.:				
Increase propane extraction		Planned		
Gulf Oil Corp., Crane County, Texas:				
Sulfur plant, tons per day	20	Building	1952	Graff Engr. & Equip. Co.
Gulf Oil Corp., St. Landry Parish, Louisiana:				
New cycling plant, cu. ft. per day	25,000,000	Building	Mid '53	
Honolulu Oil Corp., Ropes field, Texas:				
Compressor plant, cu. ft. per day	1,700,000	Planned	Late '52	
Hugoton Production Co., Ulysses, Kans.:				
Increase plant capacity, gal. per day	90,000	Building		
Imperial Sulfur & Acid Co., San Juan basin, New Mexico:				
Sulfur plant, tons per day	60	Planned		
Jergins Oil Co. of Texas, Dewitt, Tex.:				
Compressor-stripper plant		Authorized		
Lion Oil Co., Emory, Tex.:				
Sulfur plant		Building		
Lone Star Gas Co., Parker County, Texas:				
New Natural gasoline plant, gal. per day	25,000	Planned	1952	
Lone Star Producing Co., Upton County, Texas:				
New natural gasoline plant		Planned		
Magnolia Petroleum Co., Pegasus field, Texas:				
New gasoline plant, cu. ft. per day	30,000,000	Building	Late '52	Hudson Engr. Corp.
Magnolia Petroleum Co., Longville, La.:				
New gasoline plant, cu. ft. per day	3,100,000	Building	Mid '52	Blaw-Knox Const. Co.
Magnolia Petroleum Co., Clayton field, Texas:				
Separation and dehydration, cu. ft. per day	47,500,000	Building	Mid '52	Delta Engineering Corp.
Monsanto Chemical Co., Texas City, Tex.:				
Petrochemical plant		Building		
National Petro-Chemicals Corp., Tuscola, Ill.:				
Alcohol plant		Building		

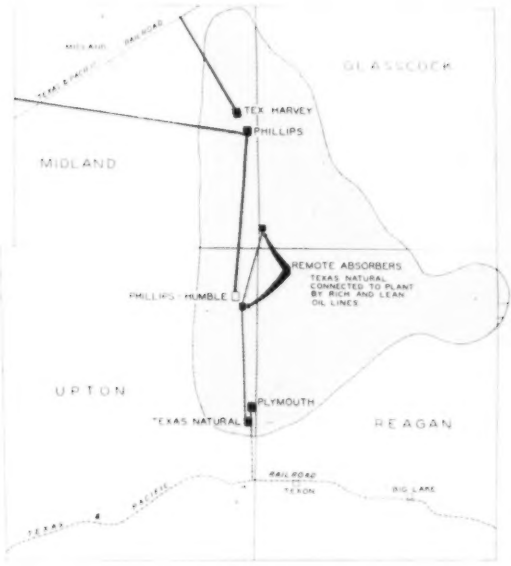
Natural-Gas Processing-Plant Building Projects (continued)

Company, location, and type of project—	Capacity rating	Status	Comp. schedule	Contractors
Northern Natural Gas Co., Holcomb, Kans.:				
Dew point control plant		Building	1952	
Ohio Oil Co., Bay City, Tex.:				
Natural-gas processing plant, cu. ft. per day	91,000,000	Building	1952	Hudson Engineering Corp.
Panoma Corp., Carson County, Texas:				
Increase plant capacity		Building	Mid '52	
Patton & Swab, Inc., Edmond, Okla.:				
Increase plant capacity, gal. per day	9,000	Authorized	1952	
Pecos Petroleum Co., Pecos, Tex.:				
Plant increase, gal. per day	22,000	Building		
Phillips Chemical Co., Borger, Tex.:				
Add reactors to carbon-black plant		Building		
New carbon-black plant, tons per year	30,000	Building	Late '52	
Phillips Chemical Co., Goldsmith, Tex.:				
New sulfur plant, tons per day	100	Building	Early '52	Ralph M. Parsons Co.
Phillips Chemical Co., Pasadena, Tex.:				
New vinyl pyridine plant, tons per year	1,000	Building	Mid '52	Stearns-Roger Mfg. Co.
New ammonia-methanol-acetylene plant		Building	Early '53	Chemical Const. Co.
Phillips Chemical Co., Crane, Tex.:				
New sulfur plant, tons per day	50	Building	Mid '52	Ralph M. Parsons Co.
Phillips Petroleum Co., Midland County, Texas:				
Natural gasoline plant, cu. ft. per day	60,000,000	Building	Late '52	
Phillips Petroleum Co., Brazoria County, Texas:				
Plant extension, cu. ft. per day	100,000,000	Building	1952	
Phillips Petroleum Co., Ector County, Texas:				
Plant increase, cu. ft. per day	75,000,000	Contracted	Early '53	
Phillips Petroleum Co., Upton County, Texas:				
New gasoline plant, cu. ft. per day	60,000,000	Contracted	Mid '53	
Plant extension, cu. ft. per day	55,000,000	Contracted	Mid '53	
Plymouth Oil Co., Tom Greene County, Texas:				
Repressure and gas-lift plant, cu. ft. per day	3,000,000	Building	1952	Hudson Engineering Corp.
Pure Oil Co., Andrews County, Texas:				
Increase plant capacity	25,000	Authorized	Late '52	
Reef Fields Gasoline Corp., Sweetwater, Tex.:				
New gasoline plant		Planned		
Royalite Oil Co., Ltd., Turner Valley, Alberta:				
Sulfur plant, tons per day	30	Contracted		Foster Wheeler, Ltd.
Shell Oil Co., Denver City, Tex.:				
Plant increase, cu. ft. per day	16,000,000	Planned		
Shell Oil Co., Elk City, Okla.:				
Plant increase, cu. ft. per day	50,000,000	Building	Mid '52	Fluor Corp., Ltd.
Shell Oil Co., Fullerton, Calif.:				
Increase plant capacity, gal. per day	15,000	Building	1952	
Shell Oil Co., Ventura, Calif.:				
Increase plant capacity, gal. per day	175,000	Planned		
Shell Oil Co., DeWitt County, Texas:				
Increase plant capacity, gal. per day	1,000	Building	Late '52	
Sid Richardson Gasoline Co., Winkler County, Texas:				
Enlarge plant facilities		Authorized		
Skelly Oil Co., Velma, Okla.:				
Plant increase, cu. ft. per day	35,000,000	Building	Mid '52	
Skelly Oil Co., Eunice, N. M.:				
Expand plant		Building	Mid '52	
Signal Oil & Gas Co., Long Beach, Calif.:				
Plant increase		Authorized		
Signal Oil & Gas Co., Huntington Beach, Calif.:				
Plant increase		Authorized		
Standard Oil Co. of Calif. (Operator), Elk Hills, Calif.:				
Natural-gasoline and repressuring plant, cu. ft. per day	50,000,000	Building	Late '52	Parsons-Macco Co.
Plant addition, cu. ft. per day	48,000,000	Authorized		
Standard Oil Co. of Texas, Snyder, Tex.:				
Add isobutane facilities		Building	1952	
Stanolind Oil & Gas Co., Andrews County, Texas:				
Injection and gasoline plant, cu. ft. per day	20,000,000	Building	Late '52	Hudson Engineering Corp.
Stanolind Oil & Gas Co., Hockley County, Texas:				
Sulfur plant, tons per day	45	Contracted	Late '52	Fluor Corp., Ltd.
Increase gasoline plant capacity		Building	1952	
Natural-gasoline plant		Planned		
Texas Gas Products Corp., Upton County, Texas:				
Plant expansion		Building	1952	Texas Natural Gasoline Corp
The Texas Co., Scurry County, Texas:				
Natural-gasoline plant, cu. ft. per day	20,000,000	Building	1952	O. L. Olson Co.
Tide Water Associated Oil Co., Ventura, Calif.:				
Repairs to natural-gasoline plant		Building	Mid '52	W. M. Barnes Co.
Alterations to absorption unit		Planned	Late '52	
Union Oil Co. of Calif., Brea field, California:				
Increase plant capacity, gal. per day	3,000	Building	1952	
Union Oil Co. of Calif., Orcutt field, California:				
Increase plant capacity, gal. per day	4,000	Building	1952	
Union Oil Co. of Calif., Sansinena field, California:				
Increase crude-oil absorption plant, gal. per day	1,000	Building	1952	
Warren Petroleum Corp., Ringwood, Okla.:				
Natural-gasoline plant, cu. ft. per day	50,000,000	Building	1952	Gasoline Plant Const. Corp.
Western Gulf Oil Co., Bakersfield, Calif.:				
Increase plant production capacity		Building	1952	
West Texas Gas Co., Fritch, Tex.:				
Modernize plant for L.P.G. production		Planned	1952	
West Gasoline Co., Cleveland, Tex.:				
Move natural-gasoline plant		Building	1952	
Wilmington Gasoline Co., Wilmington, Calif.:				
Plant increase, gal. per day	11,000	Planned		

Spraberry Operators Eye Gas as Revenue Source as Declining Oil Production Looms

by Roy F. Carlson
West Texas District Editor

Over half a million acres currently is being actively developed as the main portion of the Spraberry trend, as shown in the shaded area of the map. This area will furnish gas to the gasoline plants now being constructed or considered.



Map of Spraberry trend, showing locations of plants in trend.

MORE and more operators are beginning to look at the gas and light-liquid hydrocarbon of the Spraberry trend oil fields as a major source of revenue, perhaps as important as the crude oil. Declining oil production and increasing gas-oil ratios have initiated such thinking.

Reservoir calculations and core data give the Spraberry sand low values of effective pay, porosity, and permeability for oil—21 ft., 12.5 per cent, and 0.441 md. respectively for the upper Spraberry sand and 16 ft., 12.7 per cent, and 0.163 md. for the lower Spraberry. *(Blackwood and Christie, The Oil and Gas Journal, April 7, 1952).* These figures apply to crude oil, and are of use in calculating availability and duration of crude production. Most calculations of this kind indicate a relatively short life for any given well in the trend area.

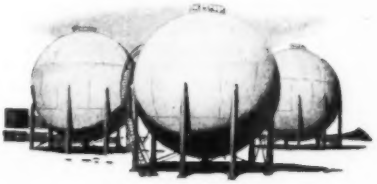
On the other hand, gas production is given a much longer life, due primarily to consideration of a larger reservoir volume more effective in producing gas than in producing oil. Basis for using a larger volume is the fact that the gas and light liquids have a higher degree of mobility in the reservoir, and consequently move through regions of lower permeability than does crude oil. Thus more of the reservoir should be effective as a gas producer.

In any event, several operators have enough confidence in the Spraberry gas and light liquids production possibilities to initiate gasoline-plant building programs in the area. Firm commitments have been made for three plants in the area. These are the Tex Harvey plant of Anchor Gasoline Corp. and Tex Harvey Gasoline Co., the Tex Harvey plant of Phillips Petroleum Co. and a plant scheduled for the Pembrook area of the trend by Phillips Petroleum Co. and Humble Oil & Refining Co. In addition, Spraberry gas and gas liquids are being taken into the Plymouth Oil Co. and Texas Natural Gasoline Corp. plants in Benedum field. Phillips has purchased a large interest in the Plymouth plant.

The Tex Harvey Gasoline Plant, Inc., installation is already in partial operation, currently processing about 9,500 M.c.f. per day as a compression plant. According to construction schedules, the plant will be processing 20,000 M.c.f. by July 1, and will be in full operation, or handling 32,000 M.c.f. by October 1, 1952. It will extract from 3 to 3.5 gal. of total product per thousand cubic feet of gas which includes about 1 gal. of 14-lb. R.v.p. natural gasoline, with the re-

The first new operating gasoline plant in the Spraberry trend is that built by Anchor Gasoline Corp. and Tex Harvey Gasoline Co. in Tex Harvey field. With the equipment shown here, it is processing about 9,500 M.c.f. of gas per day. Ultimate capacity is 32,000 M.c.f. per day, when additional equipment has been added.

Producers



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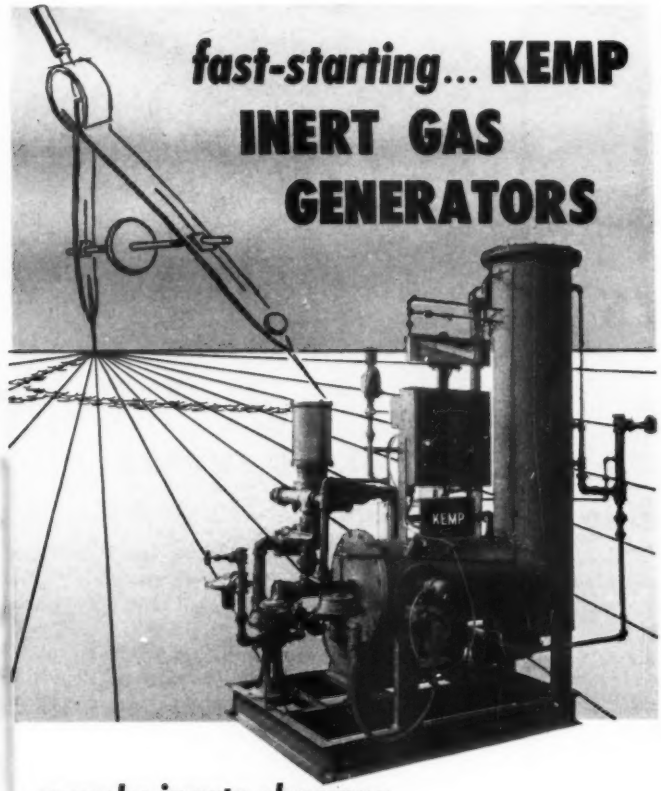

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mainder being butanes and propane. A 26-lb. R.v.p. gasoline will be manufactured.

The Anchor-Tex Harvey Co. plant was moved from a site in Michigan to the Tex Harvey area. However, most of the processing equipment and some of the engines will be new. The processing equipment, including the absorber which will be in operation on about May 10, will have a reserve capacity of about 10,000 cu. ft. daily.

Residue gas will be taken by El Paso Natural Gas Co. Products are currently being marketed in tank trucks, but it is possible that a products line will be laid to the main line of the Texas & Pacific Railroad located about 14 miles to the northwest, to load products in tank cars.

Gas volumes being taken into the two already-existing Benedum plants are currently rather small, but expansion programs are in effect in both plants to enable processing of larger quantities.

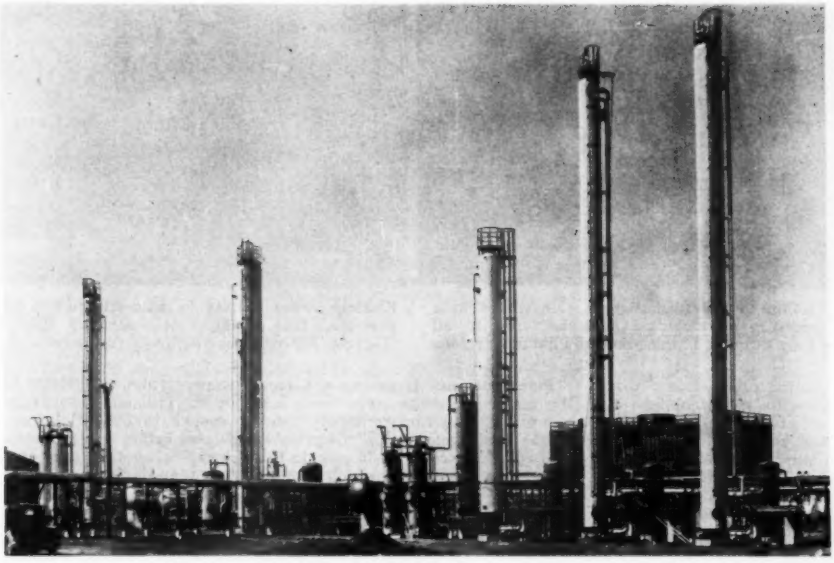
Texas Natural Gasoline Co. has formulated plans for using two remote absorbers in the field, locations of which are shown on an accompanying map. These remote absorbers will take liquids from the wet gas using lean oil pumped from the main plant. The rich oil will be returned to the plant and the light fractions will be moved there. Use of remote absorption saves a considerable tonnage in steel piping, over what would be required to take the raw gas into the plant, provided that there is a market for the residue gas at the absorber.

During February, Plymouth's plant averaged about 800,000 cu. ft. per day of input Spraberry gas, and Texas Natural's plant averaged about 2,000,000 cu. ft. per day. Gathering systems are not completed yet. Texas Natural's remote absorption system is not in place although remote compressors have been installed to boost gas into the plant.

The Phillips plant now under construction will process gas from Tex Harvey and also from Germania and other fields. As Spraberry develops, this plant is to be enlarged to 150 M.M.c.f. per day. Phillips also has interest in Plymouth's plant which is currently rated at 85 M.M.c.f. Eventually Phillips' capacity in the Pembrook area is to be upped to 150 M.M.c.f.

Anticipated liquid production for the new Phillips plant in Tex Harvey field is 4.5-5.0 gal. per thousand cubic feet, containing 40 per cent propane. The deethanized product is shipped to Borger or elsewhere for fractionation and treating at centralized processing facilities of Phillips. Absorption is to be at 450 psi.

Other plants have been considered for the Spraberry area in the vicinity of the Four Corners of Midland, Glasscock, Reagan, and Upton counties. One of these is a plant to be built by Magnolia for several operators, and another was to be built by Sohio Petroleum Co.



The Fuller gasoline plant, operated by The Texas Co., has been on stream since February. Capacity after scheduled expansion will be 23 million standard cubic feet daily.

Fuller Plant Incorporates Latest Methods And Facilities in Field Processing

by F. Lawrence Resen
Gulf Coast District Editor

A GAS-INJECTION program is under way as a followup on the new Fuller gasoline plant operated by The Texas Co., and the plant, which went on stream in the middle of February, will soon be furnishing injection gas to Cogdell field, West Texas.

Additions to the compression unit at the plant, necessary to supply both field and plant requirements, will boost wet-gas capacity of the plant from an original 15 million standard cubic feet to 23 million standard cubic feet daily and also provide an injection-gas capacity of approximately 14 million standard cubic feet per day.

The new plant, an absorption-type installation, serves Cogdell field in Kent and Scurry counties and also receives some gas from wells in North Snyder field, Scurry County. In all, around 360 wells are tied in with the plant. Five formations are being produced in Cogdell field, the major ones being the Canyon Reef, Fuller, and Strawn.

The Fuller plant and associated facilities are located in Sections 614 and 652 of Block 97, H&TC RR Co. Survey, Scurry County. The installation is located on the P. L. Fuller ranch which covers a large part of Cogdell field. The plant is approximately centered in this field.

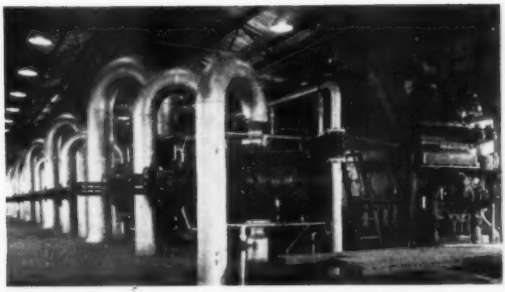
Gathering system. — The gathering system serving the Fuller plant is of the low-pressure type designed to operate at approximately atmospheric pressure at the compressor suction in the plant. The system is divided into two general parts—north and south—and feeds the plant through two main incoming lines. Elevated separators are used almost completely in the field and operate at as low a pressure as possible, approximately 7 psig.

The field proper is in fairly rough terrain and this, in turn, has contributed to difficulties in laying gathering lines. Two suspension bridges were required in the process of constructing the system. In low places in the line, drips have been installed to collect condensed liquids. These are periodically purged by using residue gas pressure where available to force the liquid into a tank truck which transports the condensables to the plant for processing. Meter runs and regulators are installed at all tank batteries.

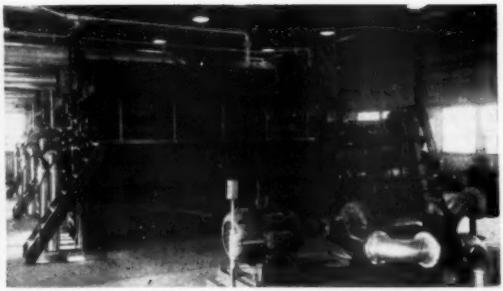
Injection program.—The gas-injection program calls for the return of all available residue gas to the Canyon Reef formation as a secondary recovery measure. A substantial increase in oil recovery is expected to result from the cooperative program when it is consummated. A hearing has been held before the Texas Railroad Commission and it has approved the secondary-recovery plans as an oil-conservation measure.

The program is being worked out through joint efforts of The Texas Co. and all the other field operators, namely, Chapman & McFarlin Producing Co., Humble Oil & Refining Co., Stanolind Oil & Gas Co., D. D. Feldman Oil & Gas Co., Progress Petroleum Co. of Texas, Warren Oil Corp., Joseph I. O'Neill, Jr., and Geier-Jackson, Inc. Most of these field operators will probably join in the ownership of the Fuller gasoline plant and injection facilities.

Specifically, the initial gas-injection



Gas for injection to the formation is compressed to a maximum pressure of 2,500 psi. and delivered to all parts of the field through a high-pressure injection system.



Electric power is used to drive all pumps and air compressors. This power is generated by 500-kw., 3-phase, 60-cycle, 480-volt gas-engine-driven generator units.

program is being planned as a nine-spot system with approximately 320 wells in the program. Gas-injection cylinders will be placed on all compressors in one compression plant for maximum flexibility in the injection operation.

Residue gas will be processed in a dry desiccant-type dehydration unit and passed through a dust filter before reaching the suction of the injection cylinders. In all, eight compressors will be available at the plant with five currently in operation and the additional three due to be in service in June. Gas will be delivered, through a high-pressure injection system, to all parts of the field for injection at a maximum pressure of 2,500 psi. The gas-injection program has been handicapped due to difficulties in obtaining materials, chiefly high-pressure pipe, and the system is expected to be ready for operation in September.

Plant Processing

The plant employs the conventional processing scheme for a natural-gasoline installation incorporating a compression unit, absorption and distillation unit, and fractionation facilities consisting of a deethanizer, depropanizer, and debutanizer.

Three-stage compression is employed for the absorption system with discharge of the third stage at 560 psi. Absorber pressure is approximately 550 psi. and design absorption-oil circulation rate is 103 g.p.m.

The original compression unit consisted of five natural-gas-engine compressors rated at 880 hp. Wet-gas capacity of the units is 15 million standard cubic feet per day. Three additional 1,100-hp. units are being installed raising wet-gas capacity to approximately 23 million standard cubic feet per day plus an injection-gas capacity of approximately 14 million standard cubic feet daily of residue for the dispersed gas system in the field. One injection cylinder will be installed on each of the eight units and the tiein will be such that varying amounts of gas can be handled depending on conditions existing at any particular time.

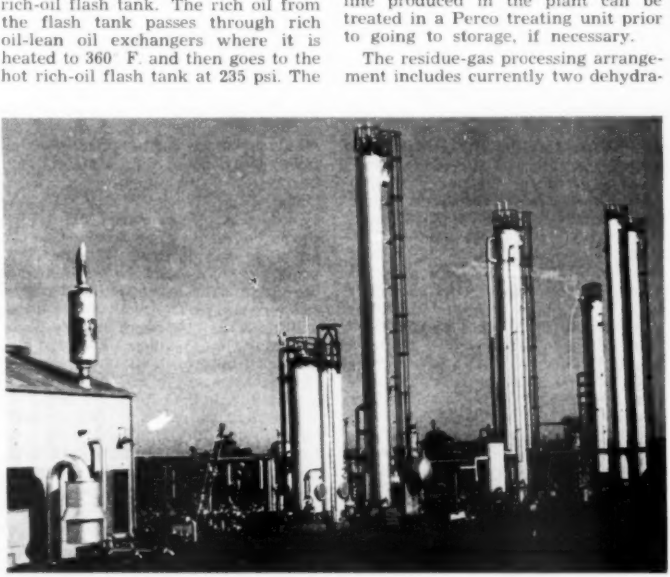
Plant suction.—Incoming gas from the north and south lines feeds into a horizontal suction scrubber thence to the first stage of the compression unit. Gas is boosted to 35 psig. in this stage, then cooled and passed through a vertical-type scrubber into the suction of the second compression stage.

Another set of scrubbers and cooler is used on the suction and discharge of the third stage. Liquid knocked out of the 150-psi. gas from the second stage is sent either to the third-stage discharge scrubber or into the steam still reflux. A considerable amount of liquid is knocked out of the third-stage discharge scrubber and is run directly to the deethanizer feed tank.

Gas from the compression unit is sent to the absorber at 550 psi. and rich oil from the absorber is flashed at approximately 260 psi. in a cold rich-oil flash tank. The rich oil from the flash tank passes through rich oil-lean oil exchangers where it is heated to 360° F. and then goes to the hot rich-oil flash tank at 235 psi. The vapors from this flash pass directly to the still and the rich oil is heated further to 500° F. in a direct-fired heater before entering the still several trays below the vapor inlet from the hot rich-oil flash.

Steam stripping.—The rich oil is stripped with steam in a still operating at 210 psi. Still overhead product, consisting of both liquid and vapor, goes to the deethanizer feed tank. The combined recycle vapor steam, consisting of vapor from the cold rich-oil flash, deethanizer feed tank, and deethanizer reflux accumulator goes to the suction of the third compression stage. Raw feed from the deethanizer feed tank is caustic-washed to remove any hydrogen sulfide before it passes to the fractionation unit. The stream then passes through a conventional deethanizer, depropanizer, and debutanizer. Gasoline produced in the plant can be treated in a Perco treating unit prior to going to storage, if necessary.

The residue-gas processing arrangement includes currently two dehydra-



Compressor house, dehydrators, absorbers, and stabilizers are included in this view of the plant yard.

tion units, a residue-gas scrubber, and a regeneration-gas scrubber. New installations for the gas-injection system include, in addition to the injection cylinders, a dust filter following the dehydrators for removing fines from the gas prior to entering the cylinders.

Plant capacity.—The plant was originally designed to extract 50 per cent of the propane, approximately 95 per cent of the butanes, and essentially all of the pentanes and heavier components in the gas. With increased capacity, however, propane extraction will be reduced to approximately 45 per cent.

Water supply.—Due to the scarcity of water in the area, the plant has been designed for minimum water consumption. Air-cooled units will be used to cool the water used for cooling engine jackets and lubricating oil. An induced-draft, three-cell, 6,000-g.p.m. cooling tower is used to supply cooling for gas and for processing requirements.

The shortage of water also accounts for the plant's low steam demand. Steam is being consumed only for rich oil stripping with the exception of a few auxiliary uses. Two 300-psi., 104-hp., oil-field-type boilers, one of which will be used as a spare, have been installed to supply the necessary steam for these operations.

The main heating medium for processing is hot oil. Two parallel, direct-fired heaters are used for supplying the heat requirements of reboilers and other necessary preheat exchangers. A third heater is used for the rich-oil system. The heaters have an individual capacity rating of 6,000,000 B.t.u. per hour.

Electrical power.—Electrical power is used to drive all pumps, air compressors, and the like with the exception of some spare units having gas-engine drives. Electrical power will be generated by three 500-kw., 3-phase, 60-cycle, 480-volt gas-engine-driven units. One of these three generators will be used as a spare.

Power is distributed throughout the plant on parallel circuits designed to minimize shutdowns due to failure of any one circuit.

Miscellaneous.—Storage facilities at the plant consist of:

5—42,000 gal. propane tanks
5—42,000 gal. butane tanks
8—18,000 gal. gasoline tanks

Three lines run to the loading rack which is located 11 miles from the plant on a main highway. All products are presently leaving the plant via the rack which is a 20-spot tank-car and 2-spot truck-loading layout.

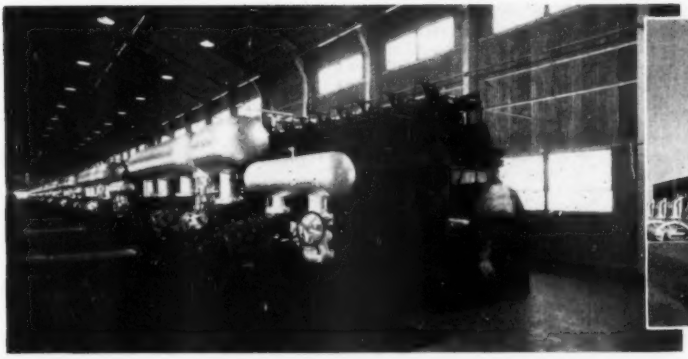
Arrangement of the plant is such that it may be adapted to any appreciable expansion in the future. Buildings include office, laboratory, combination change room and workshop, warehouse, compressor building, generator building, and boiler house. General design of the plant is open type with all process pumps located near the equipment they serve. Main control instruments are housed in two structures within the process area.

Design and construction. — Process engineering for the Fuller plant was by The Texas Co. with design and construction by O. L. Olsen Co., Houston, which firm also holds the contract for installation of additional compressors and injection facilities. Field gathering lines were installed by Holder Construction Co. Erection of the original plant was begun April 15, 1951, and it was placed on stream February 18, 1952.

The Fuller plant is in the West Texas Division of The Texas Co.'s producing department. Operations of the plant are under the supervision of C. B. Williams, division manager, and A. E. Willig, superintendent of gas and gasoline. J. W. DeFore is plant foreman.

New Tube-Testing Device

A method for determining the effectiveness of ultra-thin films of lubricants at pressures previously impossible to measure has been developed by an oil company. The instrument can exert measurable pressures up to 250,000 psi. between two metal bearing surfaces.



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Natural-Gas Gathering... *Its problems and how to meet them*

by E. F. Hindman*

Hydrate formation, dispatching problems, and alleviation of corrosion are most important considerations in this operation

A NUMBER of problems are encountered in the gathering of natural gas. Of these, three particularly troublesome factors are hydrate formation, dispatching difficulties, and corrosion.

Hydrate formation may be alleviated by indirect heaters, separators, and low-temperature extraction units at the well. Dispatching difficulties can be minimized by proper advance notice of large changes in demand. Corrosion is perhaps best controlled by cathodic protection.

Hydrates

Hydrate formation is especially troublesome in a gathering system because of the widely separated points where the gas is taken, ordinarily only a few million cubic feet per day from each field.

The layout of a typical system, of course, makes it impractical, because of the cost involved, to build more than a few dehydration plants at certain strategic junctions. The real problem, then, is to keep the gas moving without freezing from the well head to the dehydration plant. After passing through a dehydration plant of reasonable efficiency comparatively little trouble is encountered from icing conditions.

During the critical period when the gas is passing between the well and the dehydration plant, the tendency to form hydrates can be partially overcome by the use of indirect heaters, separators, and low-temperature extraction units at the well, and by the use of drips placed along the line at convenient stations.

The most recent of these developments is the low-temperature extraction, or L.T.X. unit, which is one of the better methods of reducing the moisture content. These units also increase the recovery of distillate by 10 to 20 per cent, and when properly used the water content of gas after processing has been found to be less than 7 lb. of water per million cubic feet of gas. Some companies have encouraged the use of these devices by paying a bonus when contract dehydration minimums are met.

*Louisiana Natural Gas Corp., Lake Charles, La. Paper presented at annual meeting, Southern Gas Association, April 28-30, Galveston.

Dispatching

Dispatching is a 24-hour problem within any gas company, but particularly so for the gas-gathering company. Its lines are comparatively short in length and of small diameter. Pressures are usually maintained much higher than on a transmission line, and the gas travels at a high rate of speed. Consequently, there is no cushion to speak of, in the form of a line pack, and input and output must be closely synchronized.

If a sudden cutback in volume is made by a large user without proper advance notice, it is very likely that some of the mechanical safety devices, such as bursting heads and relief valves, will be affected by the sudden increase in pressure before enough well production can be taken off the line to compensate for the reduced output. Likewise, a sudden increase in consumption without adequate advance notice will cause the pressure throughout the system to be lowered beyond operational minimums.

Since it takes a certain amount of time to put wells on the line or to shut them in, this is a real problem. Constant effort is expended to impress its importance upon the dispatchers of large users of gas.

The widespread use of automatic, and in some cases remotely controlled, pressure and volume controllers has been a great help in handling large volumes of gas, and in fact has made it possible for the gatherer to take gas from widely separated fields and concentrate it in quantity at one point with a very few men.

However, dispatching is roughly only 50 per cent operational in the modern gathering system. It is at least 50 per cent contractural and legal. Contract commitments as to maximum and minimum volumes must be constantly kept in mind when regulating day to day flow requirements.

Allowable volumes of state regulatory bodies must also be kept track of from day to day, and anticipated long enough in advance to apply for 60-day allowables. It is the experience of Louisiana Natural Gas Corp. that it takes as large a staff to keep up with the contractural and legal aspects of dispatching as it does actually to dispatch gas in the field.

Weight must be given to other factors, however. For example, flare gas is given first priority in all operating fields, and constant effort is made to protect the producers from drainage, even if it exceeds contract commitments.

It is absolutely essential, if the gatherer is to have his dispatching on a realistic basis, that he establish and keep good relations with the producers from whom he buys, and with the companies to whom he is selling.

Communications

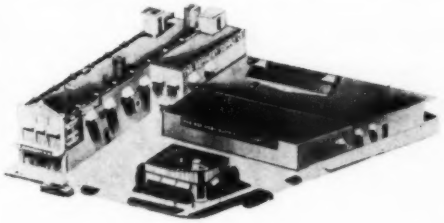
A part of the modern pipe-line system that is closely tied up with dispatching is communications. Many companies rely on private telephone systems. However, the postwar years have seen a considerable shift to the various forms of radio.

F.M. radio networks have proved the most practical for the gathering end of the industry. In larger systems, such as crosscountry transmission lines, microwave radio is gaining in use and popularity. However, it has not been tested long enough to find widespread acceptance in the gathering industry as yet.

F.M. radio has a number of advantages that appeal to the average gathering company. It is cheap enough to permit wide use, and thereby to gain full advantage of its flexibility, and it is reliable enough to be used in all but the worst weather conditions.

It is company policy to equip with radio every vital operating station and vehicle. Greatest use of the network is for dispatching and related problems. Volumes and pressures from the critical points are taken on a regular timetable, usually once an hour, and any orders for changes in volume go out by radio from the central dispatching office to men in the field.

Next to dispatching, radio is most convenient during construction work,



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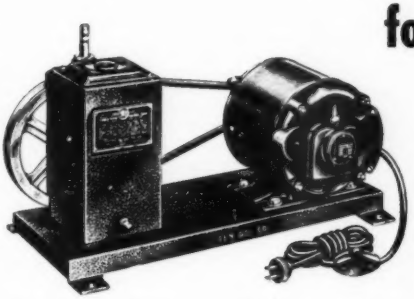

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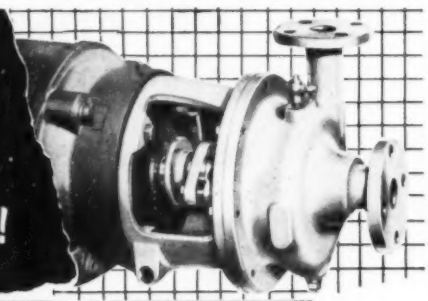

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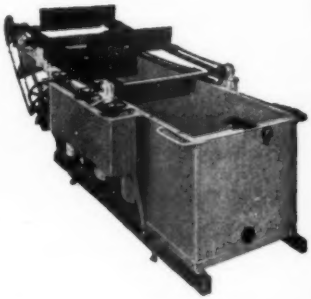

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Cathodic Protection

In the Gulf Coast area where many lines are laid in marshes and salt water, use of cathodic protection is widespread. The savings in maintenance costs alone are tremendous over a period of years.

Of primary importance in obtaining satisfactory results from the use of cathodic protection is proper insulation of the pipe so that a minimum of electrical current is required.

Three conditions are equally necessary to obtain effective insulation.

1. The use of a high resistance coating on all metallic surfaces throughout the pipe line, including valves, river weights, and road casing, as well as pipe.
2. The separation of the pipe line from other pipe lines and from nearby metallic structures such as bridges or footings.
3. The provision of insulated joints at all terminals and junctions, including delivery points, laterals, meter stations, etc.

It is not always easy to install this protection on isolated lines, especially along the uninhabited marshland of the Gulf Coast, due to the absence of available electric power at the desired places. This may be overcome in part, however, by the use of sacrificial anodes and other methods of power generation.

Most of Louisiana Natural's system is protected by rectifiers, which are connected to commercial power lines, although some sacrificial anodes are in use at isolated locations.

Cathodic protection should be installed if it is at all possible to do so.

Successful Operation

The successful operation of a gathering system depends upon careful planning and designing so that all possible strictures are eliminated, and all pipe, valves, and fittings come up to maximum pressure conditions.

Adequate provision should be made for pig traps. In some cases where older fields are being drained it has been found necessary to install field compressors to effect satisfactory recovery of the reserves. Much thought should be devoted to the arrangement and placing of separators, particularly when it is feasible to pipe gas at well pressures to a central control point where the separators can be conveniently placed in batteries. This has the further advantage of permitting quicker and more economical control of the rate of flow. Under certain conditions it is desirable to design the gathering lines in such a way that stripping or gasoline extraction plants may be suitably located.

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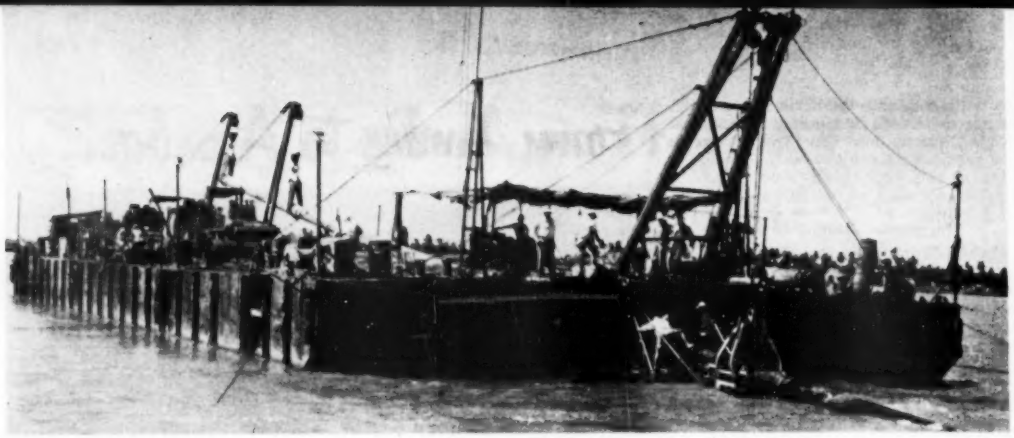


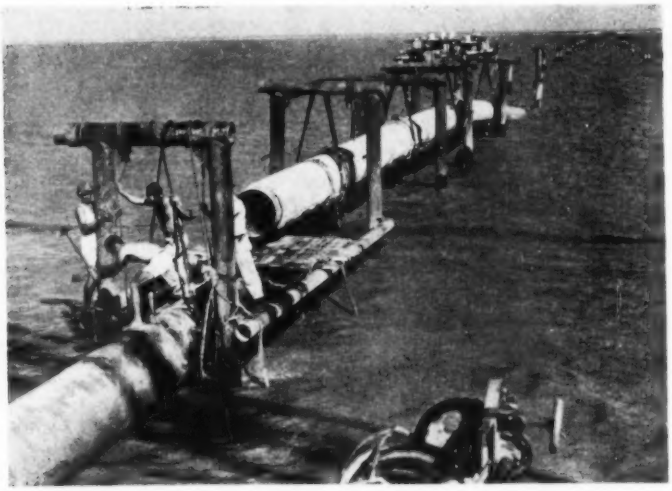
Lake Maracaibo operations for laying 20-in. pipe. The two boom tractors on the barge raise a 120-ft. section protruding thrcugh keyway to bell hole at edge of barge where the section is welded to the line.

Big-Inch Crude-Oil Line Built in Venezuela

by Paul Reed
Pipe Line Editor

"Light line project" constructed by Shell Caribbean from the Maracaibo area to the Paraguana Peninsula

THE 158-mile big-inch project just completed by Shell Caribbean Petroleum Co. from the Maracaibo area to the Paraguana Peninsula in western Venezuela is the principal crude-oil system built in South America in the past year. It has the distinction of being one of the four crude-oil systems in the world with diameters as large as 30 in.



Preparations for welding 2,000-ft. section of 30-in. pipe with Gunited concrete sheath. The line is laid between rows of piling across the Paraguana shore where Shell's Cardon refinery can be seen in the distance.

The purpose of the project is to transport crude oil from the area on the west side of Lake Maracaibo, including Mara, La Paz, and La Concepcion fields, where production has been increasing in recent years. The line will deliver to Shell's Cardon refinery and Mene Grande's terminal at Las Piedras on Paraguana.

The new system, known as the "Light Oil Line Project," is owned by three companies as follows: Shell Caribbean Petroleum Co., 88.89 per cent; Texas Petroleum Co., 6.66 per cent, and Mene Grande Oil Co. 4.45 per cent.

The conspicuous features of construction are the two long submarine crossings at Lake Maracaibo and the Golfete de Coro, the laying of approximately 13 miles on an earthen causeway across salt flats, and the aboveground building of the major part of the overland sections.

Progress of construction.—The first pipe was strung February 1, 1951. Welding began August 19, 1951. The pipe line was completed at the end of February 1952 and the pump station was finished in April 1952.

All pipe was shipped either to Shell's Cardon refinery or to the port of Maracaibo. From these points the major portion of it was transshipped by barge to beachheads at Punta Palmas, Santa Clara, and Rio Seco.

Major contractors.—Land lines were constructed by Williams Brothers de Venezuela, S.A. The marine crossings at Lake Maracaibo and the Gulf of Coro were contracted by Mahoney Contracting Co., of Venezuela. Dredging in Lake Maracaibo was done by Gahagan Overseas Construction Corp. The salt-flat causeway was built by Grant Foster Co. and Maracaibo Towing Co. The pump station was constructed by Macco Panpacific, Inc.

Pump station.—The system is served by a single pump station at Palmarejo with present design capacity of 235,000 bbl. per day at 490 psi. by operating two engine-driven centrifugal units. An additional unit has been installed as a spare. By the

utilization of the additional pumping unit, the system will have a maximum capacity of 290,000 bbl. per day at 790 psi.

Each of the three main units at the station consists of an 1,850-hp. Cooper-Bessemer dual fuel engine (gas and oil) with Farrel-Birmingham double helical gear speed increaser driving a single-stage Byron Jackson centrifugal pump.

The two suction booster pumps are Deepwell type, Pacific centrifugals with 250-hp. electric motor drive.

The station has three 500 kva. 440-volt Chicago Pneumatic dual-fuel engine-driven generator units.

Land sections.—The pipe was principally laid bare and aboveground on concrete skids. However, the 8-mile section between the Palmarejo station and the manifold on the shore of Lake Maracaibo was coated and buried.

Welding inspection.—This was carried out by qualified men provided by Shell Pipe Line Corp. X-ray inspection of field welding was conducted by International Industrial X-Ray Co. for the examination of all welds on marine crossings and a third of the welds on the land lines.

The Lake Maracaibo crossing following a 4.8-mile route was built with two lines 20-in. o.d. $\frac{3}{4}$-in.-wall Grade B National Tube seamless pipe coated with coal-tar enamel wrapped with glass mat.

For this crossing, pipe was welded in 120-ft. sections and coated in a yard at Punta Palmas. Actual laying was done from a laying barge made by converting Mulberry Harbour lighter barges for this purpose.

A special feature of the barge facilities was a builtin bell hole. There was no ramp on the barge. The 120-ft. sections of pipe were tilted to the desired angle for alignment by two TD 24 boom tractors. The adjustment of the position of the pipe in the water was controlled through manipulation of a large cradle suspended by winch line from an A-frame slanting above the bell hole at the stern end of the laying barge.

The two 20-in. lines across the narrow part of Lake Maracaibo were laid 5 ft. below the bed of the lake in two dredged trenches with a maximum separation of 1,000 ft.

The Golfete de Coro crossing of 3.7 miles was handled by procedures which differ from those used at Lake Maracaibo.

For the Golfete crossing the pipe is X 46, 30-in., $\frac{1}{2}$-in. wall in 40-ft. joints from the Consolidated Western Steel Co. plant at Orange, Tex.

Operations for coating and application of a $2\frac{1}{2}$-in. reinforced gunite sheath were conducted on the salt flats on the south side of the Golfete de Coro.

The actual water crossing was achieved by pushing 2,000 ft. floating sections from a specially constructed marine railway.

Since the gunited pipe is buoyant, the necessary ballasting was provided by installing concrete yoke-type weights over the pipe at intervals of approximately 20 ft.

The line was laid between two rows of pipe piles spaced 40 ft. apart. These pipe piles are staggered on 200-ft. centers across the entire water crossing. The last 2,000-ft. section was floated across and landed at the elevated causeway. The final weld was made in the Golfete.

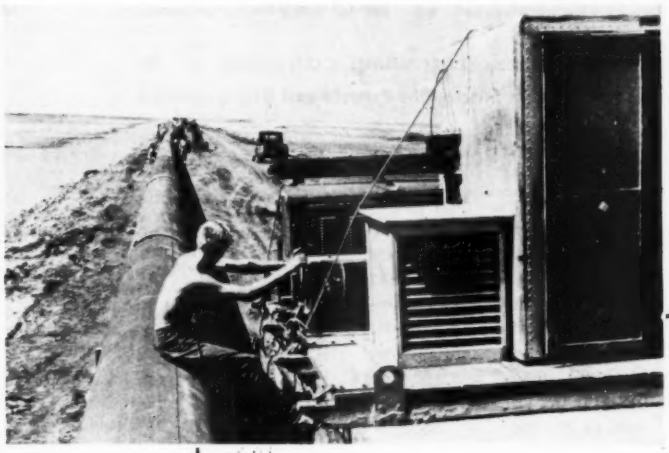
Special A-frame equipment served for aligning the pipe at the platform where the 2,000-ft. sections were welded together.

The 13-mile earthen causeway on the salt flats at the south side of the Golfete was built to a height which would insure it being approximately 2 ft. above the high water level.

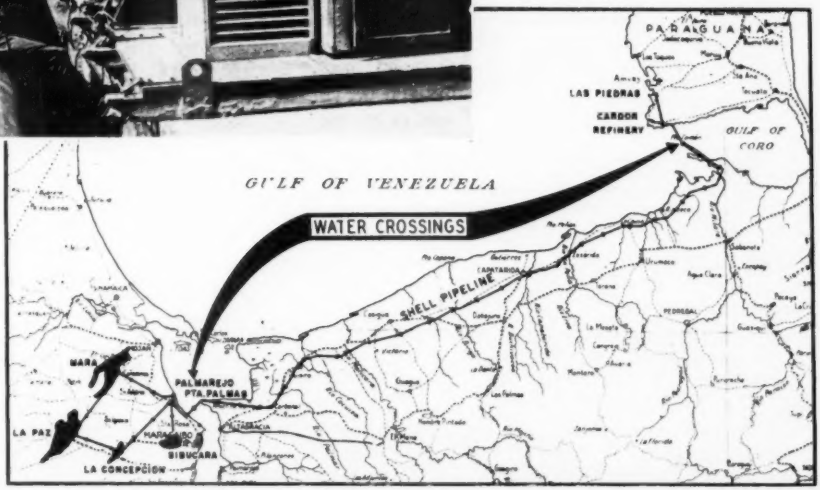
Cathodic protection is provided at both the marine crossings and the buried segment between Palmarejo and the Lake Maracaibo manifold. Bare pipe was laid aboveground on concrete skids and insulated over the major part of the route where soil resistance is low or varies abruptly.

Communication is carried on by F.M. radio between terminal points with an automatic relay midway at Dabajuro. One voice and two teletype circuits are provided. All automotive operating and maintenance vehicles are furnished with portable radio units.

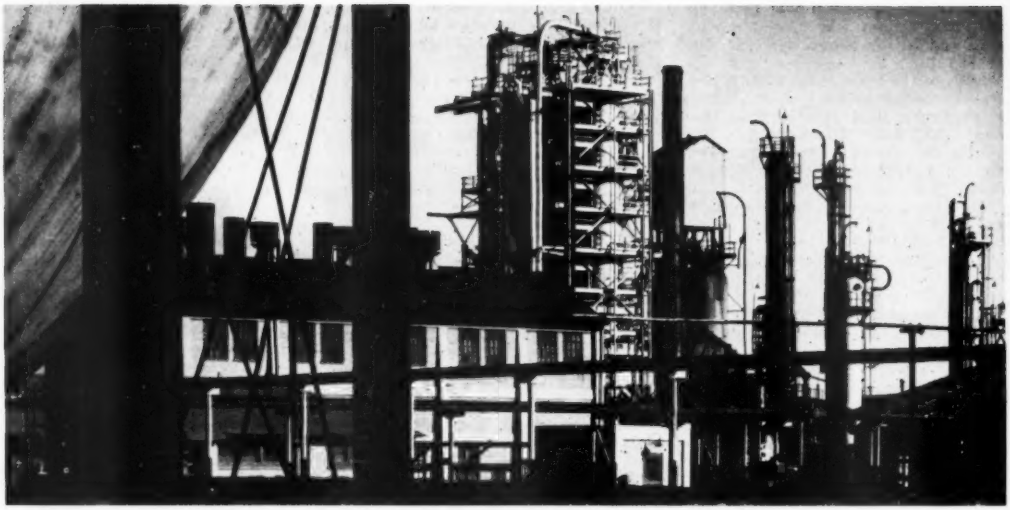
All pipe for the project totals 49,000 tons. Volumetric capacity of the line is 705,000 bbl.



Mobile X-ray photographic laboratory on causeway across salt flats at the south side of the Golfete de Coro.



Map of route of Light Oil Line project built by Shell Caribbean Petroleum Co.



This 2,600-bbl. per day fluid catalytic cracking unit, built during the war, will handle up to 7,000 bbl. per day when Frontier completes a revamping project.

How to Eliminate a Bottleneck

Frontier Refining will double catalytic cracking capacity of its war-built unit at Cheyenne, with moderate investment in equipment

by George Weber

George Weber, the Journal's refining editor, is making an extended tour of refineries and processing plants throughout the Rocky Mountain and Pacific Coast areas. This is the first of several "current status" reports that he will make during the progress of the trip.

UTILIZING excess reactor and regenerator capacity designed into a war-built fluid catalytic cracking unit, Frontier Refining Co. will more than double throughput capacity of the unit with a relatively moderate investment in new equipment. The unit was built by the Government as part of a fuels plant at Cheyenne, Wyo. It was put in operation in May 1944 by Frontier Refining Co., which later bought the unit.

Present Operation

Initially, the fluid cat unit had a design capacity for 2,600 bbl. per day. Like other units built at that time, it incorporated an oversize reactor, regenerator, and primary fractionator. The 17-ft. o.d. by 32½-ft. regenerator and the 11 by 16-ft. reactor were mounted side by side with their tops at the same elevation. The fractionator measures 8 ft. in diameter by 77 ft. in height. The entire unit has an elevation of 105 ft., and was one of the early units to show the lower profile.

By making minor revisions in flow and operations, Frontier has been able to raise capacity of the unit to its present average of 3,100 bbl. per stream day of fresh feed. The current expansion program will remove major capacity limits and will bring the unit up to the 7,000-bbl. per day level, an over-all increase of nearly 170 per cent.

The unit incorporated a few new design features; some of which have been widely adopted, and some of which were dictated by the materials shortages of the times. It was one of the first units to have a differential pressure controller between reactor and regenerator. Regeneration air was provided by an outsize reciprocating compressor operating with a 30-in. stoke and a 47-in. air end. This steam-driven unit had a rated capacity for delivering 7,000 cu. ft. of air per minute. Although it has performed with satisfaction, this type of unit was selected because of the ability to get an early delivery date, and it has represented the principal bottleneck to subsequent expansion.

The reactor and regenerator were equipped with single-stage cyclone separators. Unlike regenerators built at that time, there was no electrical precipitator, however. Instead, the flue gas plus entrained catalyst fines from the single-stage cyclone separation, charges to the base of a large scrubber tower where it is contacted with a countercurrent stream of virgin gas oil which comprises part of the reactor feed. In passing upward over the 11 side-to-side pans, the flue gas preheats reactor charge. Entrained catalyst fines are efficiently stripped and are returned directly to the system with the fresh feed stream to the reactor.

Catalyst losses for this type of secondary catalyst recovery have averaged a low 0.25 lb. per barrel of fresh feed, and voluntary catalyst withdrawal is necessary to maintain proper activity of the synthetic sulfur-resistant type used. On particle distribution, the catalyst in the system shows a higher percentage of

fines than is normal for units of this type.

Originally, the cat unit, designed by Universal Oil Products Co., was in balance with the 5,000-bbl. per day refinery in which it operated. Since that time, however, Frontier has increased crude runs to an average of 12,500 bbl. per day and while the cat unit throughput was stepped up to some extent, it is now seriously undersized to meet the current requirements for gasoline yield and octane.

During postwar operations, Frontier has successfully used the cat unit for processing and desulfurizing a whole crude fraction. This Big Horn mixture, termed Nieber-Worland crude, is a blend of two high-sulfur crudes. The mix runs an average of 34° A.P.I. gravity, 1.7 per cent sulfur, and catalytically cracks to yield a 65 per cent fraction of gasoline. The crude joins with preheated fresh gas oil immediately ahead of the reactor charge point.

Sulfur in this mixed sour-feed stream is largely converted to hydrogen sulfide, removed as deethanizer overhead, which runs about 2,000 grains per 100 cu. ft. Although no analysis of flue gas has been made, operators report that it is heavy in SO_2. Catalytically cracked gasoline from this sour stock is satisfactorily sweetened with a caustic wash, and operators consider treating no problem.

On present operations, two side streams are withdrawn from the cat unit fractionator—a light fraction for No. 2 burning-oil and diesel-oil blending, and a heavy side cut for thermal cracking. Slurry bottoms are recycled to the reactor.

Revamp Operation

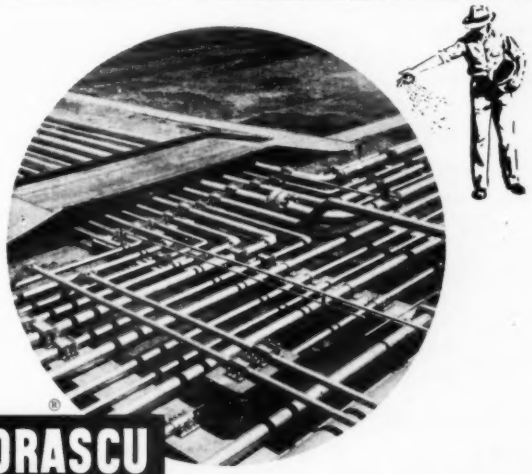
Replacement of only a few major equipment items will greatly improve the operation of the unit, and will more than double its capacity. The first item to go is the reciprocating compressor which will be replaced by a turboblower with a rated capacity for delivering 26,300 cu. ft. per minute. This unit will require 2,860 b.hp. to furnish the required air volume at the refinery elevation of 6,250 ft. It will raise the coke burning limit to 6,500 lb. per hour, a three-fold increase over the present maximum. The new unit will require 275-lb. steam as compared with 150-lb. used by the existing compressor, and operators estimate that they will save 2 lb. of steam per horsepower hour. The steam turbine driving the new blower will be of complete condensing type.

The second major change will be the retirement of the flue gas scrubber. Catalyst fines will be removed with a second stage of cyclone separators, and a waste-heat boiler generating 300-lb. steam will be installed on the revamped flue-gas line from the regenerator. The scrubber's limit on capacity is the volume of catalyst which can be returned to the reactor in the fresh gas oil feed. Normally the rate of 0.6 to 1.0 lb. per gallon caused no trouble, but when the rate rose to 2 lb. per gallon the increased viscosity of the gas-oil feed made for difficult handling.

Fractionator operation will be altered. Only the light side fraction will be withdrawn. A large bottom cut will be withdrawn to a slurry settler. Clarified slurry will be thermally cracked and the remainder recycled to the reactor. In present operations, the slurry stream from the fractionator base exchanges heat with polymerization plant feed. In the new operation, the bigger bottoms stream will generate 300-lb. steam which will be used in turn to heat poly plant feed and will provide heat for the debutanizer reboiler. The new reboiler will release a vertical heater for other refinery use.

Additional condensing capacity will be necessary for gasoline overhead from the cat unit fractionator. In the gas plant, a new compressor and additional condenser capacity will also be required. A primary absorber will be added ahead of the deethanizer. Propane recovery facilities will be installed to produce L.P.G.

(Continued on page 252)



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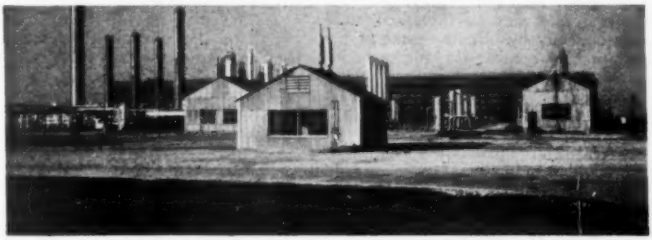

TABLE I — COMPARISON OF DRILLING DATA SHOWING THE EFFECT OF PUMP HORSEPOWER

Area and field—	Well No.	Number, size, and type bits: Jet-type drag	Conventional drag	Jet-type rock	Conventional rock	Total	Interval drilled: From	To	Total ft. drilled	Avg. ft. per bit	Hours drilling	Avg. drilling rate, ft./hr.	Avg. bit wt., lb.	Avg. circulating rate, g.p.m.	Avg. hydraulic hp.
SW Texas:															
E. Imogene	1		3 ($8^{5}/_{8}$)		4 ($8^{5}/_{8}$)	7	2,976	6,111	3,135	448	157.5	19.9	7,000	500	300
	2	2 ($8^{5}/_{8}$)				2	2,997	6,214	3,217	1,608	94.5	34.1		375	300
Texas Gulf Coast:															
Sugar Valley	1		($8^{5}/_{8}$) ($12^{1}/_{4}$)			25	0	9,778	9,778	391	443	22.1		700	400
	2	($8^{5}/_{8}$) ($12^{1}/_{4}$)				16	0	9,719	9,719	607	235	41.3		500	400
	3	($8^{5}/_{8}$) ($12^{3}/_{4}$)				14	0	9,765	9,765	697	215	45.4		550	450
Texas Upper Gulf Coast:															
Provident City	1				1 ($9^{7}/_{8}$) 10 ($8^{3}/_{4}$)	11	1,570	8,510	*6,047	550	306	19.8		600	467
	2	10 ($8^{3}/_{4}$)				10	1,477	8,348	*5,256	526	190.5	27.6	16,000	480	471
La. Gulf Coast:															
Horseshoe Bayou	1		13 ($9^{7}/_{8}$) 2 (14)		3 ($9^{7}/_{8}$)	18	108	10,140	10,032	558	336	29.9	8,000	530	340
	2		16 ($9^{7}/_{8}$) 2 (14)			18	108	10,211	10,103	562	377	26.8	8,000	520	340
	3	13 ($9^{7}/_{8}$)		1 ($9^{7}/_{8}$) 1 (15)	1 ($9^{7}/_{8}$)	16	96	10,062	9,966	623	226	43.1	12,000	530	525
	4	12 ($9^{7}/_{8}$)		2 ($9^{7}/_{8}$) 1 (15)		15	128	10,200	*10,041	670	213	47.2	12,000	550	600
Gold Meadow	1	5 ($9^{7}/_{8}$)		1 (15)		6	110	7,032	6,922	1,154	141	49.1	4,000	552	450
	2	5 ($9^{7}/_{8}$)		1 (15)		6	107	6,939	6,832	1,139	69	99.0	6,000	620	625
Weeks Island	1		7 ($9^{7}/_{8}$)		15 ($9^{7}/_{8}$)	22	4,525	11,071	6,546	297	329	19.8	10,000	575	475
	2	1 ($9^{7}/_{8}$)		17 ($9^{7}/_{8}$)		18	4,195	11,080	6,885	382	289	23.8	13,000	570	575
East Texas:															
Carthage	1				14 (9)	14	4,064	5,829	1,765	126	365	4.8	20,000	600	350
	2			10 (9)		10	4,000	5,827	1,827	183	285.5	6.4	20,000	480	350
S. Arkansas:															
El Dorado	1				18 ($8^{3}/_{4}$)	18	2,365	6,535	4,170	232	263	15.8	20,000	400	154
	2			14 ($8^{3}/_{4}$)		14	2,351	6,595	4,244	303	209	20.3	20,000	400	300
N. Louisiana:															
Cotton Valley	1				74 ($8^{5}/_{8}$)	74	4,275	9,000	4,725	64	816	5.8	40,000	528	350
	2			42 ($8^{3}/_{4}$)		42	4,010	9,000	*4,787	114	588	8.1	32,000	550	515
Mississippi:															
Sandy Hook	1				23 ($9^{7}/_{8}$)	23	1,925	8,945	7,020	305	461	15.2	17,000	509	256
	2			17 ($9^{7}/_{8}$)		17	1,835	8,969	7,134	420	227	31.5	19,000	610	468

Effect of Pump Horsepower On Rate of Penetration

by Earle C. Hellums*

Increase in bit nozzle fluid velocity instead of increase in circulation results in increased drilling rate

IN past years, output horsepower of the mud pump has been utilized in most instances to circulate the maximum volume possible. Information published in 1948[1,2] indicates that drilling rate may be increased more economically by utilizing some of the output horsepower to increase bit nozzle fluid velocity.

Results of a study made to investigate this point are presented here. These results, obtained in drilling soft and medium formations, are summarized as follows:

1. By utilizing part of the pump horsepower to increase bit nozzle fluid velocity, instead of increasing circulation, drilling rate is increased. Bit life is extended.

2. Rate of penetration is proportional to the hydraulic horsepower used to increase nozzle velocity.

3. Maximum drilling rate is obtained when available hydraulic horsepower is utilized to increase the energy of the jet stream.

Horsepower Required

The hydraulic horsepower requirement of a mud pump depends upon the volume being circulated and the pressure required to circulate such volume. The pressure required is the result of four principal elements in the rig circulating system, which are as follows:

1. Friction losses through the inside of the drill pipe and drill collars.

2. Friction losses in the annulus between the well bore and the outside of the drill string.

3. Friction losses through the surface connections, including the mud lines, standpipe, hose, swivel, kelly, etc.

4. Pressure drop across the bit nozzles.

The friction losses through the inside of the drill string increase rapidly as the volume circulated is increased, which makes this factor of prime importance in determining how the available pump horsepower will be utilized. The following example will illustrate the effect of increased volume on the friction losses in the drill pipe and also on the hydraulic horsepower required:

It would require 268 hydraulic horsepower to circulate 500 g.p.m. through 10,000 ft. of $4^{1}/_{2}$-in. drill pipe because of the 920-psi. friction loss; it would require 462 hydraulic horsepower to circulate 600 g.p.m. through the same drill pipe, be-

*Cron & Gracey Corp., Houston. Presented at spring meeting, Southwestern District, A.P.I. Division of Production, Shreveport, March 5-7, 1952

cause of the increased friction loss of 1,320 psi.

The friction losses through the annulus and through the surface connections are important, but they are relatively small compared to the drill-pipe losses. The pressure drop across the bit nozzles will vary according to the size of the nozzles used; however, this pressure drop imparts energy to the fluid jet stream, which does useful work, and its importance will be brought out in this discussion.

Drilling Records

Drilling records on a number of wells have been studied and comparative data on wells in eight selected areas are listed in Table 1. The data include wells with average drilling rates as low as 4.8 ft. per hour and also wells with average drilling rates as high as 99 ft. per hour. The data indicate that where the available pump horsepower was efficiently applied, i.e., to increase the energy of the bit fluid jet stream, the drilling rate was increased and the life of the bit was usually extended.

Data on hard-rock drilling in West Texas are not included in Table 1 because there are not enough data available at this time for definite conclusions. The limited data indicate that an increase in the energy of the bit fluid jet stream will increase the life of the bit.

Table 2 is a summary of the data on comparative wells drilled in four fields which were selected from Table 1.

South Arkansas.—Both wells at El Dorado were drilled with the same rig. It will be noted that on Well No. 1 the maximum pump horsepower available on the rig was not being used. Increasing the hydraulic horsepower from 154 to 300 and applying it effectively resulted in an average increase of 30.6 per cent in the life of the bits, and an increase of 28.4 per cent in the drilling rate, which saved 59 hours' drilling time for the 4,200-ft. interval.

East Texas.—On Well No. 1 at Carthage the hydraulic horsepower was being used to circulate a larger volume of fluid than was required, which resulted in large friction losses in the circulating system and left very little available energy in the fluid stream at the bit. On Well No. 2 the same pump horsepower was utilized more efficiently, which resulted in an average increase of 45.2 per cent in the life of the bits and an increase of 33.3 per cent in the drilling rate, saving 93 hours' drilling time for the 1,800-ft. interval.

North Louisiana.—The two wells at Cotton Valley were drilled by differ-

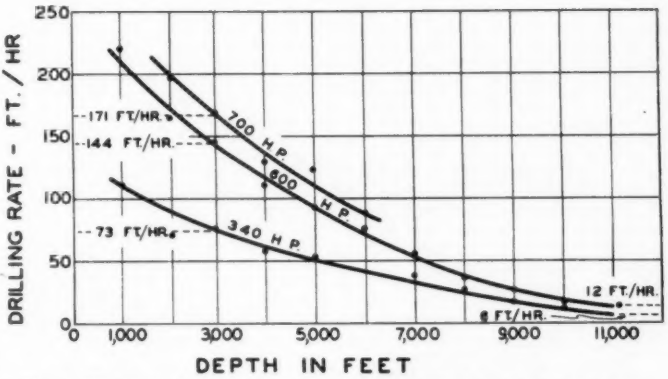

Fig. 1—Hydraulic horsepower study of wells drilled in South Louisiana.

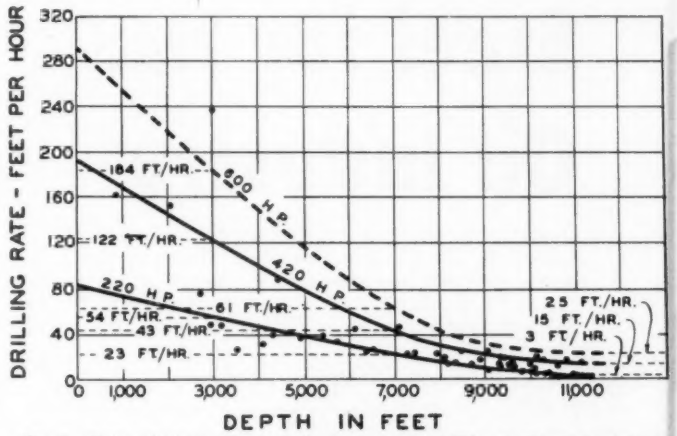

Fig. 2—Hydraulic horsepower study of deep-well drilling in South Louisiana.

TABLE 2—SUMMARY OF DATA ON WELLS DRILLED IN FOUR FIELDS LISTED IN TABLE 1 SHOWING THE EFFECT OF PUMP HORSEPOWER

Area and field—	No.	Average hydraulic horsepower	Average circulating rate, g.p.m.	Number and type bits*	Total feet drilled	Avg. feet per bit	Increase in footage per bit, per cent	Avg. drilling rate, ft. per hour	Increase in drilling rate, per cent	Drilling time saved, hours
South Arkansas:										
El Dorado	1	154	400	18 CR	4,170	232		15.8		
	2	300	400	14 JR	4,244	303	30.6	20.3	28.4	59
East Texas:										
Carthage	1	350	600	14 CR	1,765	126		4.8		
	2	350	480	10 JR	1,827	183	45.2	6.4	33.3	93
North Louisiana:										
Cotton Valley	1	350	528	74 CR	4,725	64		5.8		
	2	515	550	42 JR	4,787	114	78.2	8.1	39.7	234
South Louisiana:										
Horseshoe Bayou	1,2	340	525	33 CD 3 CR	20,135	560		28.4		
	3	525	530	13 JD 3 JR	9,966	623	10.2	43.1	51.8	120
	4	600	550	12 JD 3 JR	10,041	670	19.7	47.2	66.2	141

*CD—Conventional drag; JD—Jet drag; CR—Conventional rock; JR—Jet rock.

ent rigs, but the results are indicative of the effect of additional pump horsepower efficiently applied. On Well No. 1 where the average hydraulic horsepower used was 450, there were 74 rock bits used.

Well No. 2 was drilled with 42 rock bits when 515 hydraulic horsepower was applied efficiently. This was an increase of 78.2 per cent in the average life of the bits. The drilling rate was increased 39.7 per cent, which saved 234 hours' drilling time for the 4,760-ft. interval.

South Louisiana.—The four wells at Horseshoe Bayou were drilled with the same rig. There were 340 hydraulic horsepower used to drill Wells No. 1 and No. 2. The hydraulic horsepower was increased on Well No. 3 to 525, which resulted in an increase of 10.2 per cent in the average life of the bits and a 51.8 per cent increase in the drilling rate, thereby saving 120 drilling hours.

The hydraulic horsepower was increased to 600 on Well No. 4. As compared to the average for Wells No. 1 and No. 2, the result was an increase of 19.7 per cent in bit life, and an increase of 66.2 per cent in the drilling rate, which saved 141 hours' drilling time. The drilling data on the four wells definitely indicated that each increase in the hydraulic horsepower resulted in a corresponding increase in the drilling rate.

A study of deep-well drilling in South Louisiana showing the effect of hydraulic horsepower on the drilling rate is presented in Fig. 1. The curves are based on data obtained from wells drilled by one operator in that area. Maximum effective bit weights were applied and optimum rotary speeds based on the driller's experience were used.

Definite drilling rates for depths from 1,000 to 11,000 ft. are shown for 340 and 600 hydraulic horsepower. Drilling rates for depths from 2,000 to 6,000 ft. are shown for 700 hydraulic horsepower. There were no data available for 700 hydraulic horsepower below 6,000 ft. The study indicates that the drilling rate is proportional to the hydraulic horsepower applied, each increase in hydraulic horsepower resulting in a corresponding increase in the drilling rate.

Fig. 2 was prepared from data obtained from wells drilled in that area by another operator. Definite drilling rates are shown for 220 and 420 hydraulic horsepower; and, based on the relationship found, the theoretical drilling-rate curve for 600 hydraulic horsepower is shown. Fig. 2 verifies the principle found to exist in Fig. 1.

It is not intended to imply that the actual drilling rates shown in Figs. 1 and 2 will apply to any other areas, but the effect of hydraulic horsepower on the drilling rate that was found should apply to all soft and medium formations.

Jet Bit

An explanation of the effect of hydraulic horsepower is found by a study of the bit fluid jet stream. Under conditions of maximum effective bit weights and optimum rotary speeds, the rate of penetration of a blade bit or rock bit is dependent upon the ability of the fluid jet stream to do work, i.e., tear loose, disintegrate the cuttings, scour the bottom of the hole, and keep the bit clean.

The ability of the fluid jet stream to do work depends upon the energy contained therein, which is the product of the volume circulated and the velocity of the jet stream.

Application

1. Some of the limiting factors in the application of this principle, other than the horsepower capacity of the pump, are the maximum pressure the operator wishes to place on the surface equipment and drill pipe, and the maximum pressure drop that the bit and nozzles are able to withstand without washing out.

2. In order to obtain the maximum drilling rate at any given hydraulic horsepower, it is necessary to maintain the maximum effective weight on the bit and utilize the optimum rotary speed.

3. All of the horsepower available for mud circulation above the amount needed to maintain an adequate annular return velocity should be used

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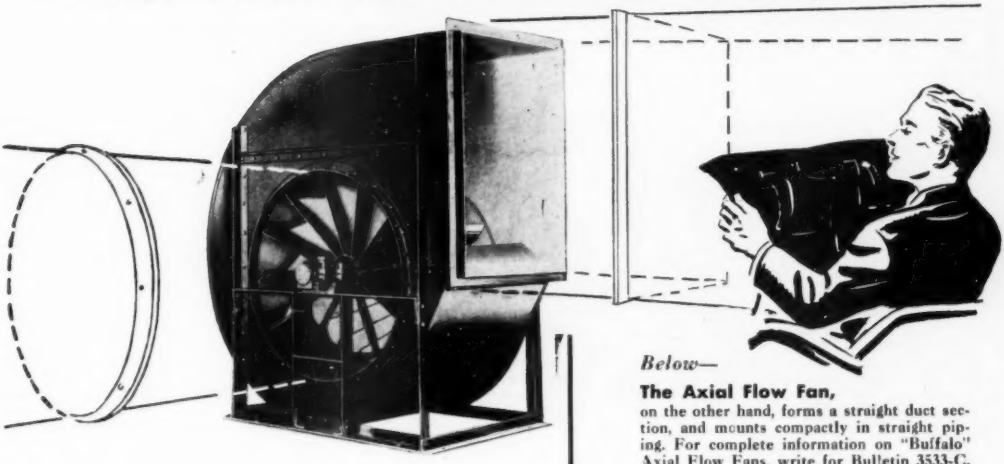

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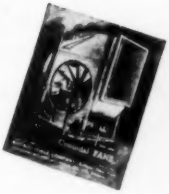

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to increase the energy of the bit fluid jet stream. This is accomplished by using the smallest size bit nozzles that the available horsepower will permit.

4. Additional information is needed on annular return velocity requirements. Present information indicates that when drilling soft and medium formations at relatively shallow depths, and when the fluid jet stream is disintegrating the cuttings, an annular velocity of 125 ft. per minute has been found to be adequate. In deeper drilling some operators consider the optimum annular velocity to be approximately 175 ft. per minute.

The author appreciates the help extended by Hughes Tool Co., Reed Roller Bit Co., Humble Oil & Refining Co., and Shell Oil Co., who submitted part of the data used in the preparation of this paper.

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How to Eliminate A Bottleneck

(Continued from page 247)

Reactor cyclones will continue in use. All present pumps in the unit are sized to handle the increased liquid loads with more power added to the steam turbine drives. Minor piping changes will be required, but no alterations will be made to the catalyst lines. Caustic scrubbing capacity must be increased, and new tankage is planned. This over-all revamping project will cost an estimated $650,000.

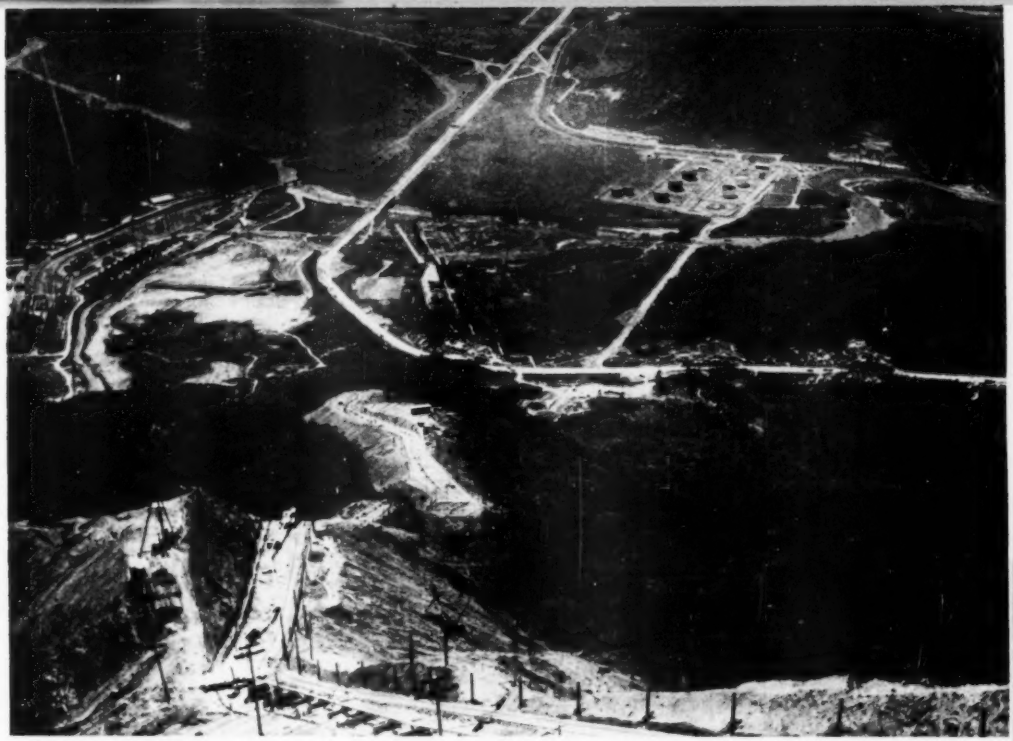
Throughput

With this expansion the cat unit will handle 6,500 bbl. per day at the same conversion level of 78-80 per cent now maintained. U.O.P. engineers aiding in the revamp engineering estimate that the unit will handle 7,000 bbl. per day of fresh feed at a 65 per cent conversion level.

At present, 1,500 bbl. per day of Neiber-Worland crude mix is charged to the reactor together with 1,600 bbl. per day of virgin gas oil. On expansion, the crude feed rate will rise to 2,400 bbl. per day. The remaining capacity will permit substantial diversion of fresh gas oil to the catalytic cracking unit; 4,100 bbl. per day of vacuum gas oil from the refinery's asphalt unit, plus gas-oil fractions from the refinery's black and green crude processing units. The mixed gas-oil stream will average 30° A.P.I. gravity.

Increased gas-oil cracking capacity will be reflected in an increase of about 600 bbl. per day in over-all refinery crude capacity. This plus the direct increase of 900 bbl. per day of Neiber-Worland crude will raise total crude capacity of the refinery from the present 13,000 to 14,500 bbl. per day. These rates will permit conversion levels similar to present ones.

As a result of the proposed revamp project, Frontier will be able to maintain its quality of 80-octane regular and 90-octane premium gasolines with roughly half the present tetraethyl lead requirements. This will leave a substantial margin for octane improvement of both grades if and when required. The project, which will be started this spring, will cost roughly one-third as much as would the building of a new cat unit providing similar capacity increase. Completion of the program is expected by early 1953.



PIPE-LINE RIGHT-OF-WAY and construction on lower part of the slopes. In the bend of the Cubatao River is the high-pressure Cubatao pumping station. Santos is about 7 miles farther in this direction.

Booming Sao Paulo Gets New Pipe Lines

SAO PAULO, Brazil, is an important industrial center of 2.5 million people. It is reportedly growing faster than any other city in the world, with industrial potential expanding at a phenomenal rate.

Sao Paulo is located 30 miles from the sea. Consequently, a great volume of imports must be moved inland from the port of Santos to meet the industrial needs of the area. Rail and highway transportation are totally inadequate.

Petroleum products, imported principally from Aruba and Trinidad, account for approximately 25 per cent of the freight tonnage moved inland. To provide adequate facilities for handling these materials, a pipe-line system is being constructed from Santos to Sao Paulo.

by William G. Heltzel*

A 10-IN. pipe line transporting gasoline, kerosine, and diesel fuel from Santos to Sao Paulo, Brazil, has been in operation since October 19, 1951. An 18-in. line currently under construction will carry a heavy industrial fuel oil.

Both lines are designed for high pressure. The Cubatao pumping station, about 7 miles from Santos, operates at pressures from 1,000 to 1,500 psi. The 18-in. line will be a "hot oil" line, the temperature of the fuel oil varying from 90° to 100° F.

An interesting feature of this pipeline system is the section on the steep slope of the Serra do Cubatao escarpment. This is a steep coastal escarpment, rising 2,500 ft. in 1.6 miles. It is composed of clay, without rock near the surface, and it is covered with dense tropical vegetation. The average rainfall is 145 in. per year; frequently it occurs in deluges. On the average, it rains 160 days in a year.

The nature of the ground, the steepness of the slope, and the heavy rainfall subject this flank of the plateau to frequent landslides, which are a hazard to the highway, the railroad, and the pipe lines that ascend it. Thus, precautionary measures are used to carry off the rainfall and to keep the right-of-ways dry.

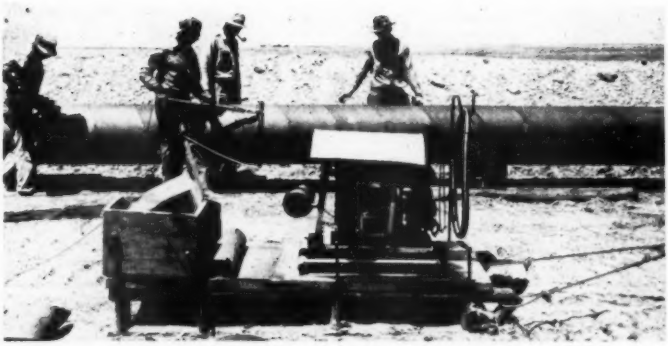
Because of these unusual conditions, the two pipe lines are aboveground, supported on concrete piers spaced 25 to 30 ft. apart and anchored by 25 specially designed concrete blocks, one at each of the 25 vertical deflection points.

The right-of-way, following a mountain ridge, has been graded into 24 uniform slopes, varying from 2° to 41° vertically and 2° to 55° horizontally. The horizontal length of the respective slopes varies from 90 to 420 ft. The sums of the horizontal distances for four 10° range of slopes are: 1,000 ft. for slopes up to 10°, 1,500 ft. for 10° to 20°, 2,000 ft. for 20° to 30°, and 1,100 ft. for 30° to 40°.

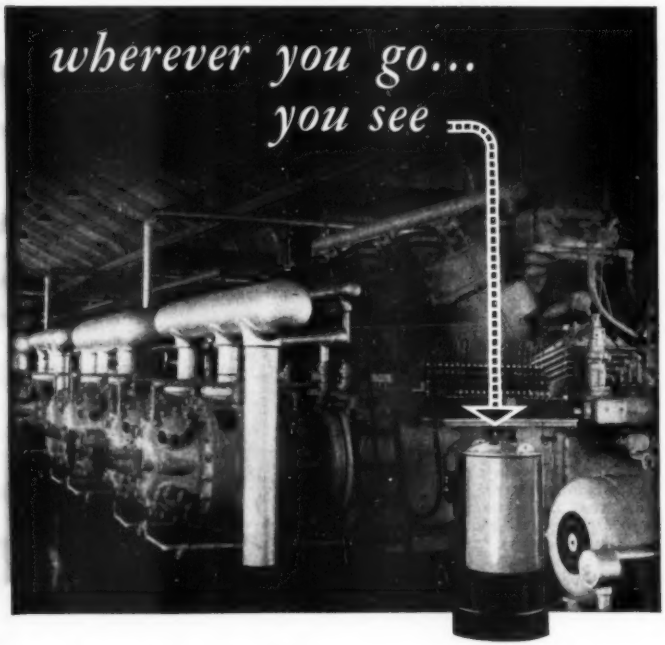
The slopes were made in accordance with a carefully determined engineering plan for the installation of the partially restrained piping system. Heavy cuts and a large amount of excavation were required. The heavy rainfall and the necessity of removing the excavated earth from the mountain slope made this phase of the job tedious and difficult. The earth could not be shoved off the mountain ridge because spoil earth causes landslides.

The pipe-line right-of-way on the slope of the Serra do Cubatao is approximately 18 ft. wide. At each side

*Consulting engineer, Tulsa, Okla.



CONSTRUCTION on the lower flank of the Serra do Cubatao.



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of it are concrete troughs for carrying the rainfall to suitable points along the route where it will be conducted and disposed of at a safe distance off the mountain ridge. A permanent cable-car railroad, with only one hoist at the top of the mountain, is installed at one side of the right-of-way. The remaining space is occupied by the pipe lines, supported aboveground by concrete piers and restrained by concrete blocks.

The entire right-of-way will be surfaced with a "black top" (fine rock and asphalt) for the purpose of keeping the underlying earth dry and impervious to the rainfall and to prevent a growth of dense tropical vegetation on the right-of-way. The preservation of a clear and dry right-of-way in this case is very important. The cable-car system is needed, not only for the construction of the pipeline system, but it is required as a means of access and for the maintenance of the pipe lines and the right-of-way. Just outside of the pipe-line right-of-way are the telephone and electrical transmission lines leading to Alto da Serra pumping station, about 2.6 miles beyond the top of the escarpment.

Because of the conditions described previously, it was decided to place the lines aboveground, using concrete supports and anchor blocks at each of the vertical deflection points. To avoid excessive stresses in the pipe lines and due to the limited thrust that could be absorbed by the anchor blocks (on account of poor soil resistance), it was necessary to lay the line for a partially restrained condition. This was accomplished by laying the lines with 5 to 6 ft. offsets between anchors, using long-radius (2 m.) factory bends at the center of each section, which is on concrete piers.

At each pier the pipe is fitted with a saddle and a lubricated sliding shoe to provide for the movement of the pipe on the supports. In this manner the pipe is allowed to move freely under the forces of expansion and contraction and it is relieved of excessive stresses.

The anchor blocks, specially designed for the local conditions, vary in size for the respective sections, according to the thrust that they must withstand. Factory bends, formed with the proper angles of rotation and provided with welded thrust rings, are used in the pipe line at each concrete block to provide, respectively, for the horizontal and vertical deflections in the line and to transmit the longitudinal thrust from the pipe line to the concrete anchor.

Straps, fitted to the pipe bend and attached by turnbuckles to the anchor bolts, hold the pipe in place against the vertical component force while the welded thrust rings, half buried in the concrete, resist the longitudinal force. The line is welded and no expansion joints are used. The 10-in. line has been in service since Octo-

ber 19 and it is reported that the zigzag, semirestrained construction has performed satisfactorily.

The consultants on this part of the project were Dr. Adolpho Santos, Jr., Sao Paulo; Fred Spielvogel, Consolidated Edison, New York, and William G. Heltzel, Tulsa. The pipe-line contractors are Techint.

Hydrocarbon Stripping

(Continued from page 175)

appear to cause considerable foaming within the absorption process. A desirable solution for the absorption-oil foaming problem is to use an oil which has proved in operation to be satisfactory. There are numerous foam-arresting compounds recommended for injection into the absorption system. The defoaming treatment has proved quite satisfactory to some operators.

Temperature Rise

The increase of absorption-oil temperature, referred to as heat of absorption, as it flows through the absorber must be coped with to maintain an optimum absorption efficiency.

A common method of removing heat from rich oil in the absorber due to heat of absorption is by intercoolers. These intercooler units consist of a liquid drawoff tray, a low-head pump, and water-cooled exchanger or atmospheric cooler. This type unit may be used from one to several times in one absorber as required depending on the richness of the gas and the per cent of absorption desired. A special base cooling unit is being employed very satisfactorily in plants absorbing rich gas. The base cooler unit is fed with rich gas and rich oil. The simultaneous absorption and cooling effects substantial absorption of propane and increasingly greater quantities of heavier hydrocarbons in the base cooler. Some intercooler systems consist of internal tube bundles mounted inside the absorption vessel which are cooled with water or a refrigerant circulating through the tubes.

Overload

Many operators have been confronted with the problem of handling a volume of gas considerably in excess of design capacity of the absorber. Such an overloaded condition contributes to the previously enumerated absorber-operation problems.

In some cases the increased load above the original design capacity is of such magnitude and projected duration to economically justify installation of an additional absorption unit to operate in parallel with the original unit. In cases where the average tray specifications or dimensions have been used, it is possible to redesign the existing trays for higher capacity or to replace trays with units having high capacity for the additional liquid and vapor loading.

Several tray designs are now on the market which are reported to increase capacity of the average existing absorber by as much as 50 per cent.

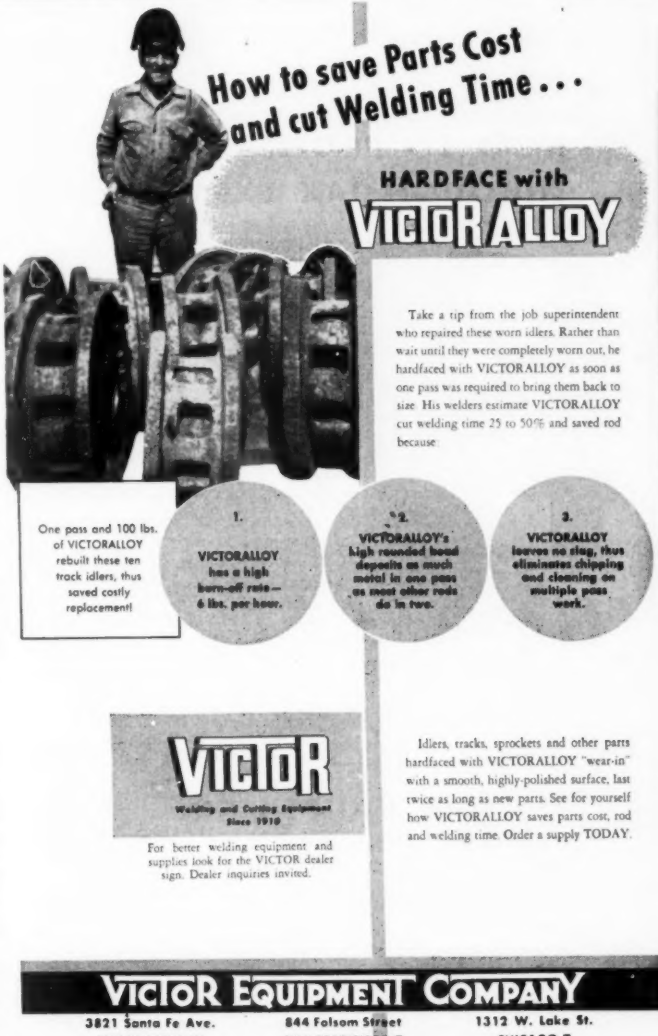
Energy Conservation

Numerous absorption-plant process arrangements include a major loss of energy when rich oil is flashed from absorber pressure, ranging from 500 to 1,200 psig., to the rich-oil flash-tank pressure which is commonly in the range of 200 to 300 psig.

Recent installations have been made to utilize this available energy in the relatively high-pressure drop from absorption to flash-tank pressure. The high-pressure rich oil is circulated through a hydraulic or rotary unit used as a driver which is coupled to a similar unit utilized to pump some stream. A typical installation is one which pumps the lean absorption oil to the reabsorber. This type installation and others that may be worked out offer attractive prospects for conservation of prime power by eliminating one or more conventionally powered units. It is possible to recover as high as 70 per cent of the available energy by the use of such a unit.

Dry Distillation

Before discussing dry distillation a brief review of the general operating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scheme of various absorption oil stripping units is in order.

Some operators are continuing to utilize the early-day two-section distillation unit in which the first vessel is the stripping section from which the raw-product vapors are delivered to a second tower known as the dephlegmator. Cool water is circulated downward through the dephlegmator to condense the raw-product vapors from the stripping section. The presence of water in this type system, which originates from stripping steam and dephlegmator water, is a continuous problem due to corrosion and the additional load placed on product dehydrating facilities.

A common stripping scheme is to feed the preheated rich oil direct to a combination unit which consists of stripping and rectification sections in one vessel as shown in Fig. 3. In this system most of the hydrocarbon product will flash at or near the feed tray. Final stripping is accomplished by the introduction of steam below the bottom tray.

Some plants employ a multiple distillation system, using the primary or high-pressure unit for maximum product condensation and the secondary or low-pressure unit for the final separation of the gasoline from the oil. This system is particularly applicable in plants processing distillate.

In the past few years Warren engineers have developed a dry distillation system which has proved to be quite successful. Dry distillation may be defined as a process employing hydrocarbon vapors to strip natural gasoline and lighter hydrocarbons from the absorption oil. The general method of accomplishing this is shown by the simplified flow diagram in Fig. 4.

In the system shown in Fig. 4, as well as in other stripping methods, it is desirable to bring the rich oil to the highest possible temperature before introducing it into the still. Considerable amount of this heat is transferred to the rich oil by means of conventional oil to oil exchangers.

At some point in the oil-exchange system a flash drum is installed for the purpose of flashing the lighter hydrocarbons from the rich oil. Care should be taken to place this flash drum at such a point that low-molecular-weight vapors will be available for the primary stripping in the still. This process feature makes possible utilization of desirable light stripping vapors which are inherently available in the rich-oil stream.

The final stripping vapor volume will be substantially reduced when used in conjunction with a primary stripping stream. The flash vapors are preheated as shown in Fig. 4 before entering the still, at approximately the midpoint of the stripping section, and the preheated final stripping medium is introduced below the bottom tray.

In plants manufacturing propane the final strip vapors are taken from the overhead of the deethanizer column. These ethane vapors, like the primary strip vapors, are heated before being introduced into the still. By using a high-purity ethane stream in this operation, the stripped oil saturation may be consistently maintained as low as .25 per cent. This degree of saturation is satisfactory in plants recovering 80 per cent of the propane.

The stripping scheme shown by Fig. 5 is similar to the previous system except that it includes feeding of the excess flash vapors from the flash drum to the rectification section. This feature does not decrease stripping efficiency and reduces the heating and cooling duties in the system. The ratio of primary stripping to excess vapor streams may be 3 to 1; however, the distribution must be determined for each still, depending on the rich-oil composition.

Data taken from one operating plant as shown by Fig. 6 establish the optimum ratio of primary to final stripping vapor as 2.6 to 1 for a still operating at 90 psig. and 500° F. base temperature and using 180-molecular-weight oil. The primary stripping vapors are fed at the rate of 1.16 cu. ft. per gallon of lean-oil circulation and the secondary or final strip

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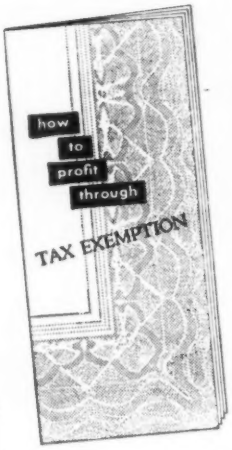

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vapors at the rate of 0.44 cu. ft. per gallon.

On a tower such as just described, a feed temperature of 500° to 525° F. is most desired. This permits the minimum of final strip or agitation vapor; however, the stripping efficiency will be approximately the same if the feed is 450° F. and the final strip vapor volume is increased 10 per cent.

Computations and operating experience have proven that 180-molecular-weight absorption oil can be stripped to .5 per cent saturation by use of a primary stripping medium only, with the complete elimination of final or secondary stripping medium.

In Warren operations residue gas has been used as a final stripping medium with success. This is to be avoided if at all possible due to added difficulties in the condensing of the still overhead vapors.

The hydrocarbon stripping operation has certain advantages and some limitations over steam stripping. Operating experience and design data should be employed to determine if a rich-oil stream may be satisfactorily stripped by hydrocarbon vapors.

Some desirable features of dry stripping are:

1. Elimination of a steam plant.

2. Reduces equipment corrosion.

3. Control equipment freezeups will be materially reduced.

4. In plants which dehydrate the gas before it enters the absorber, propane or product dehydration may be eliminated.

Undesirable features of hydrocarbon stripping include:

1. A fixed recycle volume of noncondensed vapors.

2. Some added difficulty in condensing products vapors.

Underground Storage

Considerable work has been done on utilization of underground storage for butane and propane. While this article is not intended to discuss that phase of the business, mention of one operation which Warren Petroleum Corp. has used with success, is desirable.

At Warren's Breckenridge plant in Stephens County, Texas, a cavern was mined out to store 750,000 gal. of L.P.G.

After preliminary core drilling was completed, a shaft 4 ft. square was sunk to a depth of 223 ft. passing through a limestone formation at 175 ft. and bottomed on another limestone formation. The shale between these two formations was removed creating a cavern of approximately 100,000 cu. ft. This cavern was not completed as a rectangular opening but was in the form of an inverted trapezoid with the width at the top approximately 35 ft. and the bottom 18 ft. wide. The cavern and piping is shown diagramatically by Fig. 7.

This cavern has been in use for over a year and has given very satisfactory results. After the first filling and evacuation, the storage loss was slightly over 5 per cent. The second filling resulted in a loss of about 2½ per cent and belief is that these losses will be negligible on the next evacuation. Evacuation of this cavern is accomplished by the use of recycle vapors through a compressor as shown by Fig. 7. Product purity and color upon evacuation did not change at all and was equal to products being stored in steel storage containers.

Oil Wells Use Much Steel

It takes an average of 44 tons of steel pipe for each oil well drilled in the United States. This does not count drill pipe or pipe lines, but only the tubing and casing of the well. For the industry to drill 44,000 wells this year, almost 2 million tons of pipe will be needed.

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New light on the

Economics and Operation of Portable Gas-Engine Compressor Units

by Robert C. Loomis*

PORTABLE gas-engine compressor units can be economically justified for definite applications in the gas industry. Although they will not replace permanent installations, increased use of unitized portable compressors is expected because of flexibility and ease of installation and removal.

The term "portable compressor unit" or "unitized compressor" has been applied to a compressor mounted on a skid-type structural steel base and incorporating all of the auxiliary equipment required to make the unit a complete operating compressor plant.

The auxiliary equipment, in addition to the usual engine accessories, includes jacket-water cooler, lube-oil cooler, gas cooler, gas scrubbers, and starting air compressor, plus controllers, gages, and other miscellaneous equipment.

Design Basis

Both two-cycle and four-cycle gas-engine-driven compressors have been utilized in the fabrication of portable compressor units. For ready adaptability to unitization, the compressor unit should meet the following requirements of basic design:

1. The unbalanced horizontal and vertical inertia forces and couples should be at a minimum to reduce vibration and foundation requirements.

2. The weight and size of the unit must be such that it can be transported easily and economically without special hauling permits or special equipment.

3. Although the unit must be compact, all important service points must be accessible for inspection and easy maintenance.

4. Performance and durability must not be sacrificed, even though the unit is light in weight.

5. The unit should operate satisfactorily with atmospheric cooling under widely varied climatic conditions.

The gas-engine-compressor manufacturers have met these requirements by producing small, lightweight, higher-speed gas compressors. Naturally there is variance in the individual designs, each manufacturer following somewhat the characteristic design features of its larger, moderate-speed equipment.

In general, modern lightweight, high-speed compressor units operate in a speed range of 400 to 600 r.p.m. and have power cylinders with a bore and stroke of about 8¼ to 9¾ in. The engines are available with two to eight cylinders and with a rated horsepower ranging from 80 to 440 b.hp.

On a comparable horsepower basis, compressors operating in the 550 to 600-r.p.m. range weigh only about two-thirds as much as engines of the same make which are designed to operate in the 300 to 350-r.p.m. range. In addition to reduction in weight, improvements in balance have been made so that these small units need only about one-third the foundation mass that is required by the slower speed units of comparable horsepower.

Because of the reduction in size, accomplished by increase in speed, the portable engines require only about one-half the cubical space that would be occupied by a convential, permanently installed compressor of the same horsepower.

It is this type of gas-engine compressor having two-thirds the weight, requiring one-third the foundation, and occupying one-half the space of the conventional compressor, that has made "unitization" practical.

Portable unitized compressors are suitable for a large number of services in the gas industry. These uses include field compression of small amounts of gas, booster service, injection and recycling, and supplemental capacity for existing compressor stations.

Automatic Controls

Portable units are designed to perform their compression services as economically as possible. Therefore, they are often equipped with automatic controls so that they can be safely operated unattended. These controls include jacket-water temperature controller, lube-oil temperature controller, and gas temperature controller. Control of temperatures may be accomplished by the use of either automatic shutters or temperature control bypasses.

It has been found that in some cases it is desirable to mount the shutters on the inside of the radiators to prevent air from the fan passing through the radiator section, striking a shutter, and recirculating back through the radiator. In one case it was necessary to install shutters on the outside of the radiators in addition to those on the inside in order to prevent an extremely hard and cold wind from overcooling.

Instead of shutters, some units have been provided with thermostatically controlled bypasses. However, caution should be used in the design of bypasses for extreme cold-temperature operations to insure that under severe conditions, the water in the jacket water section does not freeze, the oil in the oil cooler become too viscous, or hydrates form in the gas section. This condition can occur in much the same manner as water in an automobile radiator can freeze even while the car is operating.

In addition to the automatic temperature controls, portable units are usually equipped with automatic shutdown devices. Thus, in the event of high jacket-water temperature, low oil pressure, hazardous amounts of liquid in the intake, or excessive engine speed, the units automatically shut off.

Installation Practices

Portable units are installed in the field in a variety of ways, usually on a more or less temporary basis. Some units are simply set in place on a reinforced-concrete pad. Others are provided with a roof supported by an open-sided structural steel or pipe framework. In other cases the unit itself is equipped with its own roof

"A comparison of the average figure of $280 per compressor horsepower for the stationary installation and the corrected cost of $217 for the portable unit, shows a saving of $63 per available horsepower in favor of the portable unit."

*Pacific Lighting Gas Supply Co. Presented at Transmission Conference, Pacific Coast Gas Association, Berkeley, Calif., April 2 and 3, 1952.

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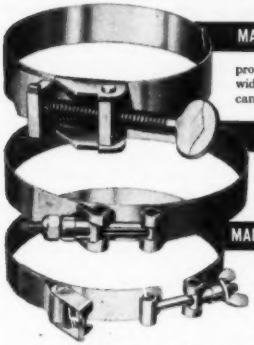

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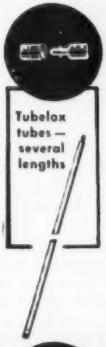

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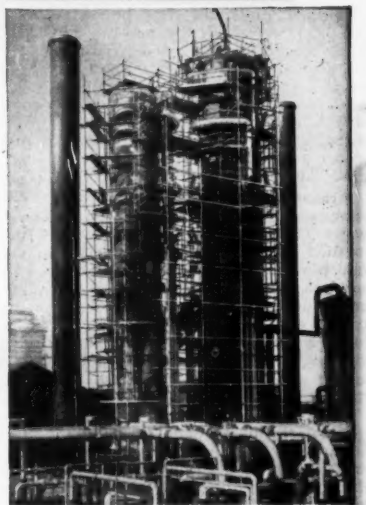

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or canopy designed to protect it against the weather.

Some of the units now in use in the field have been constructed with the skid filled with reinforced concrete. This is done by first welding reinforcing steel to the structural members of the skid and then pouring the entire unit solid with concrete. This reduces the steel requirement, supplements the foundation requirement, and gives a clean, smooth deck over the entire skid. Also, hollow voids and pockets in which oil and water might accumulate, and which are hard to drain and clean, are eliminated.

In these units, since the bottom of the skid presents a flat, smooth surface, the entire skid, if desired, can be leveled on its concrete pad and grouted in place. Several grout holes are provided in the center of the skid so that additional grout can be forced down through these holes to insure a complete, continuous layer of grout under the whole skid.

Atmospheric coolers for unitized compressors are designed in various ways. The earliest and most common method used a belt-driven vertical fan blowing air across the cooling sections. Consideration should be given to the orientation of a unit of this type so that the fan will not be forced to work against a prevailing wind and also to guard against a recirculation of hot air from one unit back into the fan of an adjoining unit.

Some units are designed so that the fan and cooling sections are mounted horizontally, with cool air being drawn into the bottom, discharged through the cooling sections and out the top. Other units making use of vertical discharge have the fan mounted above the cooling sections in such a manner that the cool air is pulled out of the bottom and over the coils before being discharged vertically.

Another variation of cooler with a vertical discharge makes use of centrifugal blowers to supply the necessary air. Prevailing winds will have less effect on coolers with vertical discharge and there is less likelihood of recirculating air from an adjoining unit.

Skid Arrangement

There are three ways in which the various components of a portable compressor plant may be arranged on the skid:

1. All of the equipment may be placed on a single, one-piece skid, the auxiliary equipment being driven by the compressor engine.

2. The skid may be divided into two sections, with the compressor engine on one skid and the fan, radiators, and auxiliary equipment on the other skid (the fan still being driven by the compressor engine).

3. Again, the skid may be divided into two sections in the same manner, but with the fan driven by a separate source of supplemental power such as a multicylinder industrial-type gas engine.

A two-skid arrangement with supplemental drive may be loaded and transported in two pieces. It also has other advantages. The use of supplemental power allows all of the horsepower of the compressor engine to be used for compressing gas. Mounted on two skids, the equipment may be used as a complete compressor station; or, if the need should arise, the compressor itself (without its auxiliary equipment) can be easily moved into an existing compressor station where jacket-water and cooling facilities are already available.

Economics

Completely fabricated portable units including compressor, skid, fabrication, and all materials ready to be moved out to the job can cost anywhere from $130 to $260 per brake horsepower. The exact cost depends, of course, on the size, type of equipment, and refinements which are included.

Individual factors which will affect this cost and which account for the wide variation are:

1. Size and type of compressor engine.
2. Number of compression stages.
3. Provisions for gas cooling.
4. Number of scrubbers.
5. Pressure rating of gas piping.
6. Type of unloader for unloading gas compressor for starting.
7. Type of compressor cylinder unloaders.
8. Inclusion of gas cylinder volume bottles.
9. Inclusion of main gas inlet and outlet header valves.
10. Type of radiator sections.
11. Type of temperature controls.
12. Ambient temperature for which unit is designed.
13. Pressure-relief valves.
14. Drain lines and valves.
15. Gages, gage boards, and instruments.
16. Automatic safety shutdown devices.
17. Automatic load and speed controls.

Thus the price can be expected to vary over a considerable range.

In order to have a concrete basis on which to evaluate the portable unitized compressor, its installed cost should be compared with that of a conventional permanent installation of similar capacity. In order to do this, the following assumptions are made:

1. The gas compressor will be for 500 lb. single-stage natural gas compression.

2. The engine and gas cooler will be accomplished by atmospheric radiators.

3. The installation will be in small units of three or four and not to exceed compressor size of 330 hp.

4. The installation will be made in the southern California area at a site where grading is unnecessary, and where the ground condition is average.

The prices used in this comparison, while not representing equipment of any particular make, agree closely with the current prices of the leading manufacturers. The fabrication and construction costs used represent average prices of several operators and contractors over a period of time, corrected to reflect today's labor and material costs.

Portable installation.—The price of the gas compressor-engine complete with compressor cylinders, muffler, air cleaner, flywheel guard, tachometer, one gas unloader for each cylinder, and all miscellaneous engine accessories, is approximately $90 per brake horsepower, f.o.b. factory. Allowing $3.50 per brake horsepower for freight the delivered price of the engine will be about $93.50 per brake horsepower.

The cost of fabricating this engine into a portable unit could vary greatly for the reasons previously enumerated. However, to turn out a complete unitized job, similar in capacity to the stationary units a cost of $91 per brake horsepower should be allowed. This includes all costs of fabrication, material, and equipment except the gas engine compressor itself.

Thus, the total cost of the completely fabricated unit ready for loading on the truck for delivery and installation is $184.50 per brake horsepower.

Assuming that the unit will be installed on a reinforced-concrete pad 15 to 18 in. thick in a typical field manner with an open corrugated galvanized iron roof supported by an open-sided steel structure, an additional $21.50 per brake horsepower should be allowed to cover the cost of the pad, the structure and roof, and loading, hauling, setting, and connecting the unit.

This brings the total installed cost of the portable plant to $206 per engine brake horsepower, installed and ready to compress gas.

Stationary equipment.—Here again, considerable variations in cost are encountered. Current installed costs are found to vary from $220 to $310 per compressor brake horsepower. This wide variation is influenced by the size and design of the plant, the type and size of equipment installed, and the refinements included. In addition, the method of contracting the work and the accounting practices used explained some of these variations.

The f.o.b. price of the same size conventional compressor, with similar equipment, is almost identical to that of the portable. The only significant difference is a slight increase in transportation cost because of the greater weight of the conventional unit.

The total cost of a comparable permanently installed stationary plant was determined by consulting with contractors who have recently de-

signed and installed complete compressor plants; and also by analyzing the cost of comparable existing installations and applying correction factors, reflecting increases in labor, material, and equipment costs to bring such cost up to date. In this manner an average estimated cost of $280 per compressor brake horsepower was determined. This figure covers the entire plant cost, including all auxiliary equipment.

Figures for the portable unit were based on a 330-hp. unit with approximately 5 per cent or about 16.5 hp. of the engine power reserved for driving the fan and auxiliary equipment. Therefore, only 313.5 hp. is available for gas compression. Thus, by applying a correction to take this fact into account, instead of a cost of $206 per engine brake horsepower, a final cost of $217 per compressor horsepower for the portable unit is obtained.

A comparison of the average figure of $280 per compressor horsepower for the stationary installation and the corrected cost of $217 for the portable unit, shows a saving of $63 per available compressor horsepower in favor of the portable unit.

The economic advantage of the portable unit is not limited entirely to its low initial installed cost. Its advantage also lies in the high percentage of its cost that can be recovered upon removal, and the ease with which it can be removed.

Although each plant will satisfactorily perform the same function, the portable installation leaves much to be desired so far as protection from the elements, comfort of the operating personnel, and convenience of operation and maintenance are concerned. Also, where larger compressor engines can be utilized in the permanent station, the cost per horsepower is reduced and the economic advantage of portable units is minimized.

Operating costs.—Field experience in operating and maintaining these portable units has been too limited to draw any definite comparisons. It is not possible to say the portable units should be either more or less expensive to operate than conventional engines of comparable rating. However, portable engines do perform well and meet the manufacturer's fuel guarantee.

Improvement

In those cases where portable compressor units have not performed as satisfactorily and dependably as might be expected, one or more of the following factors may have been involved:

1. The engine was an early model, lacking some of the later improvements in design. (Engine manufacturers have been prompt to study the field performance of their products, and have taken speedy action to modify or redesign their equipment in the light of their findings.)

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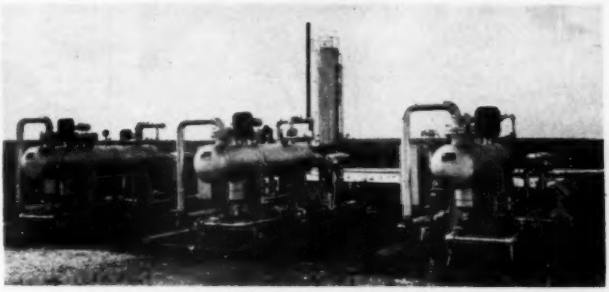

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2. The equipment was operated in the open, exposed to the destructive forces of wind, dirt, sand, and rain, subject at times to excessive overloads, and often without adequate attention.

3. The engine was operated by field men not familiar with compressor operation; who, because the units were in the open and installed on a temporary basis, did not take the pride in their operation and maintenance that would ordinarily be given to a permanent type of installation.

To obtain the best performance, the engine should be adequately protected, and operated by personnel trained and experienced in engine and compressor operation and maintenance.

Considerable improvement has been made in gas engines suitable for portable unitization; engines being built today are vastly superior to those of a few years ago. Although they run at a higher speed, portable engines have shorter strokes than the larger engines, and are designed for approximately the same piston speed, compression ratio, and brake mean effective pressure. Therefore, if given the same care and attention, portable engines should approach the dependability of performance that now obtained from conventional engines.

Before recommending portable units over conventional compressors simply because of their apparent economic advantage, consideration should be given to certain intangible values. The parts of the portable engine are smaller and lighter to handle, but the unit is often more compact with less room in which to work, and with less accessibility for overhauling and maintenance.

A permanent installation provides better protection for the equipment, a more comfortable working place for employes, and better facilities for overhauls. And finally, from the purely aesthetic viewpoint, permanently installed plants usually present a better appearance than temporarily installed portable units.

If the equipment is to be utilized only for a short period, or if it is anticipated that it will be moved, the use of portable units may be advantageous. On the other hand, if the compressor facilities will be used for a considerable period of time, a permanent conventional station may offer the most advantage.

Cooling-Tower Water Treatment

(Continued from page 177)

Treating costs were on the order of $5.11 per day and there is evidence supported by photographs that this system, polyphosphate, chromate, sulfuric acid feed, was not entirely satisfactory inasmuch as corrosion was prevalent. By utilizing a mixture of Kontol and SP-8 for both scale and corrosion control, it was found that treating costs might be reduced to $0.37½ per day. The concentration of SP-8 and Kontol used ranged from 1 to 1,000 (1,000 p.p.m.) to 1 to 75,000 (13 p.p.m.). The material was an effective corrosion inhibitor in all of these ranges, and the following are the results of a 2-week coupon exposure in the cooling-tower water system of Plant A. The coupon showed no pitting and the following data are reported:

Exposure period, days	14
Weight loss, grams	0.09
Weight loss, grams per year	2.34
Penetration, i.p.y.	0.0018

It is of interest also to supply a water analysis of the makeup water and the circulating cooling-tower water.

Constituent—	Original water (p.p.m.)	Make-up water (p.p.m.)
Sodium	879	3,031
Calcium	65	24
Magnesium	30	94
Sulfates	0	0
Chlorides	1,200	4,210
Carbonates	0	203
Bicarbonates	615	930
Silica	14.4	52
Iron and aluminum oxides	0	0

It should be noted that the water is concentrated approximately 3½ times. Relative calcium and magnesium contents in the water should be about 260 p.p.m. calcium and 120 p.p.m. magnesium. Actually the values are 24 p.p.m. calcium and 94 p.p.m. mag-

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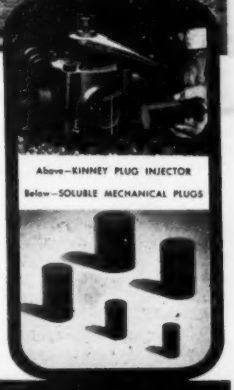

Above—KINNEY PLUG INJECTOR

Below—SOLUBLE MECHANICAL PLUGS

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nesium. This indicates that a substantial amount of calcium and magnesium carbonate is being precipitated. Apparently the deposits are remaining dispersed in the water and being discharged by tower blowdown and practically no scaling was present in the system.

As with all shell-and-tube heat-exchanger operations, some probing will be necessary. For instance, when a piece of scale or foreign material flakes off, it is deposited on the inlet side of the heat-exchanger tubes, thus decreasing water velocity. According to some authorities scale is formed directly on the surface of this confining equipment, particularly if the latter is hot, while other authorities are of the opinion that insoluble salts separate at varying distances from the surface and adhere upon contact.

The author is more inclined to agree with the latter theory, since it more nearly expresses the effect of SP-8-Kontol treatment in preventing the adherence of scale forming solids to confining surfaces. If and when a "sludge" does develop as a result of decreased water velocity, causing the insoluble salts to precipitate, the sludge thus formed is loose and soft in character and can be washed out rather than bored out.

The SP-8-Kontol treatment has been used satisfactorily in the cooling-tower water system of three compressor plants. Two of the plants utilized conventional shell-and-tube heat exchangers while the third used open-type atmospheric sections of the cooling tower.

The material was field tested in an effort to mitigate corrosion in a gasoline-plant cooling-tower water system in West Texas. The Kontol-SP-8 treatment provided protection only under certain conditions, and apparently was not satisfactory under the conditions for which it was used, and therefore, its use was discontinued in this plant. Although it was at first thought that this failure might be due to excess sulfate ion in the water, control tests show that sulfate ion has no effect on the protection offered by these compounds and that the conclusion at present is that something extraordinary is present in the cooling-tower water such as naturally occurring organic compounds or trace ions are promoting a pitting-type attack.

It is also believed that perhaps an insufficient amount of the SP-8-Kontol mixture was present. It has been found by laboratory tests that an insufficient amount of polar-type organic inhibitor does induce severe pitting attack.

In all cases the water is recirculated and is concentrated 3½ to 5 times.

Other than the economic value, this type treatment has a further advantage in that no daily chemical testing of the water is necessary, thus releasing an operator for more important jobs. An additional advantage is presented inasmuch as the tower blowdown water contains no poisonous matters, and the disposal of poisonous waste waters containing chromates is always a problem.

Theory of operation of SP-8-Kontol treatment at present can only be surmised. A rationale for the mechanism of the use of Kontol in preventing corrosion is presented:

It is believed that the Kontol corrosion inhibitors function by forming a tightly adherent adsorbed film on metal surfaces, a film which is perhaps only one molecule thick or at most only a few molecules thick. The forces responsible for the adsorption of the molecule on the metal surface are not well understood but are probably a combination of van der Waals forces and those forces responsible for chemical union such as electron-pair bonds. Indications are that the hydrocarbon portion of the molecule is oriented outward and these hydrocarbon radicals are probably sufficiently closely packed to create a barrier to migration of molecules of corroding agent through the film.[5]

The action of SP-8 in scale prevention at present can only be surmised. It is assumed that scales do not grow on metal surfaces in smooth sheets, but rather from centers of activity. The surface activity of the SP-8 is sufficient to enter the cracks and crevices in the scale and dislodge the scale by spalling from the metal surface. It then appears to preferentially coat the metal surface with a film of SP-8.

A good explanation of the surface activity involved would necessitate an extensive excursion into a rather complicated physical chemistry which would require much more of a discussion.

It is believed, admittedly based on insufficient evidence, that the SP-8 probably functions by interfering with the growth of crystals of calcium carbonate and/or sulfate which normally form an adherent scale. The SP-8 compound forms a high-molecular-weight cation, to the extent that it is ionized, which might be attracted to the carbonate or sulfate ion in the surface of a microcrystal. Since this organic ion would be very large compared to the normal calcium ion occurring in the crystal, it would thus create an irregularity in the surface of the crystal and greatly hinder its growth to a larger size.

This organic radical would also probably offer much less chance for adhesion to metal surfaces and would thus decrease the tendency for the microcrystal to form an adherent precipitate. Further, its small size would favor its being carried along in the circulating water system.

There is no ready explanation or rationale to cover the synergistic effect observed between Kontol and SP-8 in lowering corrosion. It might be supposed that if the SP-8 compounds have a strong tendency to combine with anions, which it is thought to do when it adsorbs on a microcrystal of carbonate, it might combine with hydroxyl ions to form a high-molecular-weight amine at or near the cathodic areas of the corrosion cell where the hydroxyl ion concentration is high. This free amine might be relatively insoluble in high alkalinities and might thus tend to blanket and interfere with the behavior of the cathode. This effect, combined with a pictured general adsorption of Kontol, might cooperate to give a low rate of corrosion.[6]

References

1. Nordell, Eskel, "Water Treatment," pp. 219-222.
2. U. S. Patent Re 23,227.
3. U. S. Patent 2,589,195.
4. Personal communication, C. M. Blair to W. F. Oxford, Jr.
5. Ibid.
6. Ibid.

Gas-Turbine-Driven Compressors

(Continued from page 179)

it would mean manning with full crews an additional 10 main-line compressor stations.

We anticipate, from our studies of the gas turbine, that it will be possible to operate with fewer personnel than in the reciprocating plant at a ratio of approximately one to four. From our economic comparison it was evident that the gas turbine had a low installed cost and the lowest operating cost. Through the cooperation of General Electric Co., specialized maintenance crews are being trained. The maintenance of these stations is to be handled by two or three centrally located maintenance crews along our pipe-line system.

As you can well understand, the type of maintenance to be expected in operating gas turbines would be similar to the operation of steam turbines in central power plants. The central power plants do not attempt to have always available maintenance crews capable of handling all mechanical problems that would exist in maintaining or repairing steam turbines.

As mentioned previously, we are faced with a serious shortage of water. Reciprocating compressor stations require an extensive cooling system, which obviously must be accomplished with air cooling equipment. Heat dissipation favors the gas turbine by an approximate ratio of 1 to 8; therefore, considerably less cooling equipment is required. The gas turbine is being equipped with air washers, using water spray. These washers have dual purposes—removal of large quantities of dust that are present, and to cool the air by evaporation for summer-time operation. The gas turbines are rated 5,000 hp.

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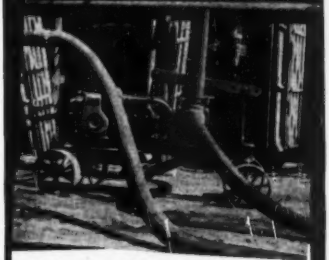

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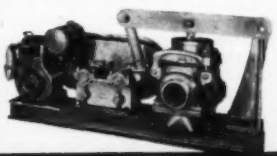

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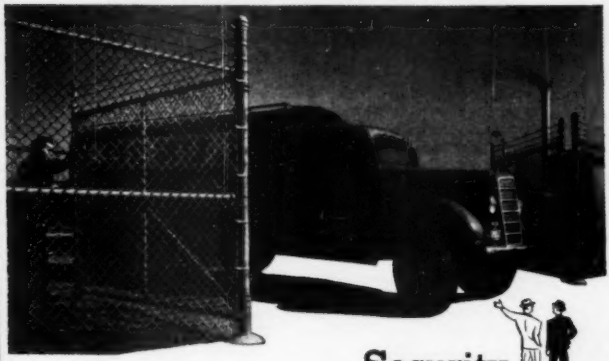

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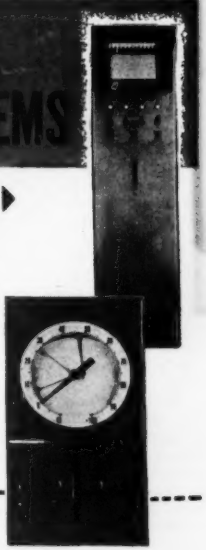

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INSTRUMENT DAVIS DIVISION

DAVIS EMERGENCY EQUIPMENT CO., INC.

66 HALLECK ST., NEWARK, 4, N. J.

at sea level and 80° F. ambient air temperature.

Since the summer-time temperature in this area reaches a dry bulb of 115° F. and a wet bulb of 60° to 65° F., considerable cooling of the air is possible by evaporation. By the evaporation of approximately 10 g.p.m. of water in the air washers it is possible to obtain rated performance of the turbine. The horsepower of the turbine is proportionate to the inlet air temperature; for example, at an air temperature of 40° F., the output is 6,400 hp., or 25 per cent increase above its rated capacity. This inherent characteristic is desirable in order to meet high load factors during winter operation.

The gas turbines being installed on our pipe line are of the "split-shaft" type. By this is meant that the shaft that drives the axial flow compressor is not rigidly connected with the shaft that drives the centrifugal gas compressor. The gas turbine takes air at the rate of 80,000 cu. ft. per minute. It is compressed through the axial flow compressor to 6 atm. This air at approximately 450° F. is exchanged with the exhaust gases in the regenerator and its temperature elevated to 800° F. before entering the combustors.

The regenerator is merely a shell-and-tube exchanger that is exchanging heat from the exhaust gases to the compressed air. Fuel is burned, using part of the air for combustion, thereby increasing the temperature of the gases to 1,450° F., and is then introduced to the high-pressure turbine, which drives the axial flow compressor. The remainder of the energy in the gases, which is the work available, passes through the low-pressure turbine, driving the gas centrifugal compressor. The exhaust-gas temperature is 880° F. before entering the regenerator, and 520° F. to atmosphere.

Due to the split-shaft arrangement of the turbine, the speed of the gas compressors may be varied from 2,000 to 5,500 r.p.m. This allows for a rather high loadability of the compressor throughout this range. With this variable-speed characteristic it was possible to select compressors which would follow the pipe-line characteristics and give us a very wide flexibility in operating pressures and volumes.

Accompanying is a perspective of the gas-turbine-driven centrifugal compressor stations as they are being constructed. The gas piping leading to and from this centrifugal compressor is in some respects typical of the practices used in existing centrifugal compressor stations operated by other companies in the industry. All the valving in this piping system will be automatically operated from the control center and synchronized with the starting and shutting down sequence of the gas turbine.

Note the absence of a fire wall between the centrifugal compressor and the gas turbine. Considerable thought was given and time devoted to consulation with the insurance companies before deviating from present practices. The compressor seals as constructed and vented eliminate the possibility of gas escaping within the building and, therefore, it is not considered that the elimination of the fire wall has made the installation more hazardous.

Special care is given to the gas piping inside the compressor building to eliminate all possibility of gas leakage. We do not consider the installation of the gas-turbine compressor station any different in fire and explosion hazards from the reciprocating compressor station, where spark plugs and magnetos present equal hazards.

Operation of the gas-turbine-driven compressor station has received all the engineering at our command, both from our organization and from the suppliers of equipment, and, on the strength of that, we have no reservations in predicting its successful operation.

What's Happening In Fractionation?

(Continued from page 184)

uct flow controller where the level is also recorded on the chart. The controller is also equipped with a low-level alarm to protect the pump from emptying the accumulator and upon the level becoming too low a horn is sounded and a red light on the control panel goes out. The red light is identified by a tab to distinguish it from seven other red lights for similar purpose so that the source of the alarm is immediately identified.

Heat supply to the system is furnished from the 20-psi. exhaust steam system introduced at full pressure to the heating element of the reboiler. Temperature is regulated by a rate-of-flow controller and control valve on the steam condensate from the reboiler reset by a pneumatic-type recording temperature controller actuated from the eighteenth tray above the reboiler. An alternate temperature control point is located in the reboiler but temperature regulation from the eighteenth tray above the reboiler works much better on this particular unit.

In another plant where the rate-of-flow controller on the feed is manually reset and the temperature of the feed is regulated, better results are obtained with the temperature control point in the reboiler. At this other plant a short cable, pneumatic type, temperature controller was installed and the control point moved to the reboiler. At first this did not operate properly, but upon putting the feed to the system on manual reset and installing a temperature controller on the feed, the system operates around the clock and through any abrupt atmospheric temperature change without adjustment of temperature control.

Again referring to the plant being described, the base product withdrawal is regulated by a level controller on the reboiler and after passing the heat exchanger is pumped through a cooler and is metered en route to storage. The level control valve is on the downstream side of the meter flange.

The pneumatic-type temperature regulator used on this system has a 40-ft. temperature cable reaching from the location of the instrument at ground level to the control point at the eighteenth tray above the reboiler. An indicating potentiometer connection is in the reboiler. In operation it is found that the readings on the potentiometer do not follow the recording of the pneumatic temperature controller by a fixed temperature increment upon atmospheric temperature changes. Is is therefore obvious that the temperature cable of the temperature controller is not sufficiently compensated for temperature change and is not registering a consistently correct temperature. Furthermore, as these inconsistencies between temperature readings occur the ratio of the rate of production between the overhead product and base product varies on the records of the meters metering these products to storage. Operating experience has shown that the set temperature of the pneumatic temperature controller must be adjusted to maintain a constant temperature reading on the indicating potentiometer as atmospheric temperature varies. When this is done, consistency of rates of production is reflected on the product meters and specification purities of both iso and normal pentane are produced.

All control instruments in this plant are pneumatic type. Temperature recording and controlling are accomplished by an indicating temperature transmitter located as near as possible to the control point with the recording controller located on the control panel in the control room. Measurement recording and recording controlling are accomplished by an indicating flow transmitter near the orifice flange with the recorder or controller on the control panel. All instruments common to a unit are grouped on the control panel so the entire operation of the unit may be conveniently observed. All control instruments are equipped with manual control dials so the instruments may be serviced with the minimum of interruption and without pinching block valves.

It was recognized, at the time of selection of instruments, that for temperature controlling more accuracy would be accomplished and one fewer instruments used, if electronic-type instruments were selected. Electronic instruments do not have the underwriters' approval of safety in hazardous areas and it was desired to locate the potentially hazardous process

pumps in the control room for operating convenience and to minimize operating labor requirement. However, a few electronic instruments including a large multipoint indicator are located behind plate-glass windows in the center of the control panel. They are enclosed in a vapor-tight room accessible only from the outside wall of the control room.

The fractionation-system pumps and loading and blending pumps are all of the heavy-duty process type with single glands and equipped with single-seal-type mechanical seals. They are 3,500 r.p.m. direct connected by spacer couplings to totally enclosed explosionproof electric motors. These units have given excellent service. Seals on the pumps have never had what could be called as much as a minor failure.

Aside from one of the pumps which takes suction directly off the base of one of the fractionation towers, which had two very minor leaks during the first 6 months' operation as a result of excessive scale and dirt entering the pump, all pumps operated 2½ years before it was necessary to go into several of the pumps and resurface the bronze ring portion of the seal. No liquid or vapor leaks can be seen and it is doubtful that a flame test would show any leaks.

At the time this plant was designed it was found that the most economical type plant to obtain the recovery of products desired, with minimum fuel, required the use of process steam in the still. Further studies pointed the way to condensing-type turboelectric generators for electric power in which the steam generators for mechanical-drive turbines and for two heating services could be operated as one central steam plant at one operating station.

All pumps in the plant are centrifugal type and, except for four large horsepower services powered by mechanical-drive turbines, with the exhaust used for heating the reboilers of the fractionators, they are powered by electric motors. Thus, through the careful study and selection of the type plant, equipment, and instrumentation, the plant is practically maintenance free and operates in push-button fashion requiring only three shift operators to produce about 3,200 bbl. daily of an aggregate of six separate products including ethyl and house-brand gasoline made from the hexane-plus product.

In conclusion, the foregoing substance may briefly be summarized as follows:

1. In multiple fractionation of a product of the character represented, intermediate separation followed by binary separation may be accomplished with less equipment and at an appreciable saving of energy than by consecutively fractionating the products from the charge stock in the order of volatility.

2. The greatest efficiency and maximum capacity of a fractionation system can be attained only through ample and good instrumentation properly applied.

3. Maintenance may be held to a very low figure through the proper selection of equipment, the selection of low-value product stream condensing and cooling temperatures in water cooling and condensing services and, though not previously mentioned, constant and careful conditioning of cooling water.

Oil Compounds Help Defense

Petroleum-base compounds were used to "mothball" machines in army arsenals after World War II. Now a degreaser employing a different petroleum-base product is making the machines ready for reuse quickly. This is only one of the ways in which petroleum aids the mobilization effort.

Plastic-Coated Tubing Passes Corrosion Test

Manufacturers of plastic coatings have been working with petroleum technicians on the problem of corrosion in oil-well tubing. At completion of a 5-month test, ordinary pipe was corroded deeply after being subjected to a daily flow of 100 bbl. of oil and 5,000 bbl. of iodized salt water.

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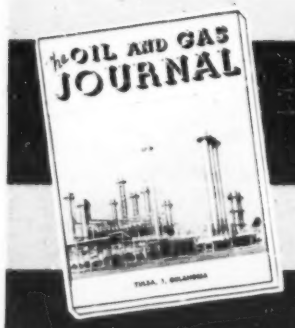
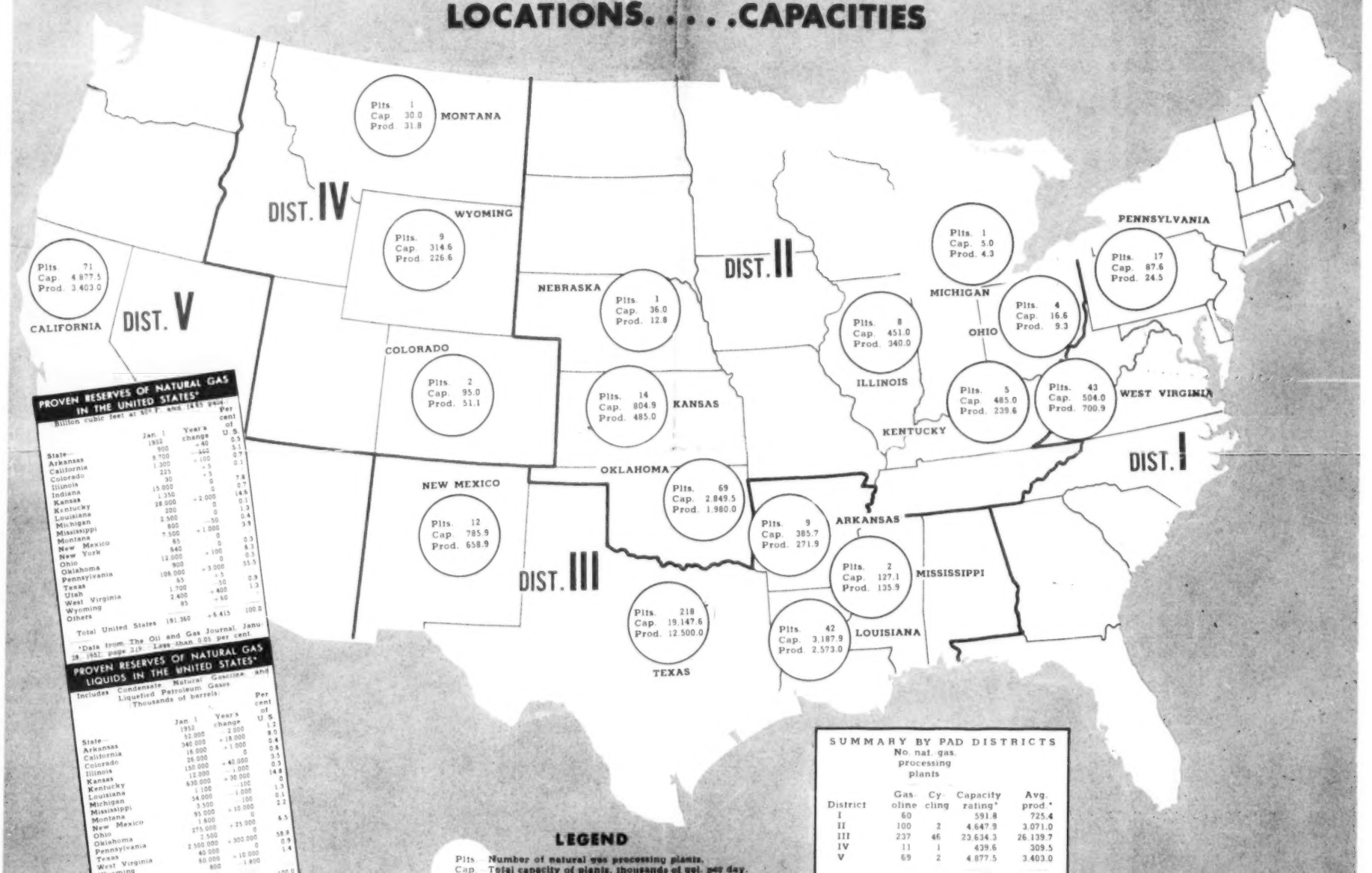


Journal-Guide to

UNITED STATES

NATURAL GASOLINE AND CYCLING PLANTS

LOCATIONS. . . . .CAPACITIES



PROVEN RESERVES OF NATURAL GAS IN THE UNITED STATES*

Billion cubic feet at 60° F. and 14.65 psia

State	Jan. 1 1952	Year's change	Per cent of U.S.
Arkansas	900	+ 40	0.5
California	9 700	[illegible]	5.1
Colorado	1 300	+ 100	0.7
Illinois	225	+ 5	0.1
Indiana	30	0	
Kansas	15 000	0	7.8
Kentucky	1 350	+ 2 000	0.7
Louisiana	28 000	0	14.8
Michigan	200	0	0.1
Mississippi	2 500	- 50	1.3
Montana	800	+ 1 000	0.4
New Mexico	7 500	0	3.9
New York	65	0	
Ohio	640	+ 100	0.3
Oklahoma	12 000	0	6.3
Pennsylvania	900	+ 3 000	0.5
Texas	106 000	+ 5	55.5
Utah	65	- 50	
West Virginia	1 700	+ 400	0.9
Wyoming	2 400	+ 60	1.3
Others	85		
Total United States	191 360	+ 6 415	100.0

*Data from The Oil and Gas Journal, January 28, 1952, page 218. Less than 0.05 per cent.

PROVEN RESERVES OF NATURAL GAS LIQUIDS IN THE UNITED STATES*

Includes Condensate, Natural Gasoline and Liquefied Petroleum Gases
Thousands of barrels

State	Jan. 1 1952	Year's change	Per cent of U.S.
Arkansas	52 000	+ 2 000	1.2
California	340 000	+ 18 000	8.0
Colorado	16 000	+ 1 000	0.4
Illinois	26 000	0	0.6
Kansas	150 000	+ 40 000	3.5
Kentucky	12 000	- 1 000	0.3
Louisiana	630 000	+ 30 000	14.8
Michigan	1 100	- 100	0
Mississippi	54 000	- 1 000	1.3
Montana	3 500	- 100	0.1
New Mexico	93 000	+ 10 000	2.2
Ohio	1 500	0	
Oklahoma	275 000	+ 25 000	6.5
Pennsylvania	2 500	0	
Texas	2 500 000	+ 300 000	58.8
Utah	40 000	0	0.9
West Virginia	60 000	+ 10 000	1.4
Wyoming	800	- 1 800	
Others			
Total United States	4 200 000	+ 436 000	100.0

*Data from The Oil and Gas Journal, January 28, 1952, page 218. Less than 0.05 per cent.

LEGEND

Plts.—Number of natural gas processing plants.
Cap.—Total capacity of plants, thousands of gal. per day.
Prod.—Average daily production, thousands of gal.

SUMMARY BY PAD DISTRICTS

District	No. nat. gas. processing plants: Gasoline	Cycling	Capacity rating*	Avg. prod.*
I	60		591.8	725.4
II	100	2	4 647.9	3 071.0
III	237	46	23 634.3	26 139.7
IV	11	1	439.6	309.5
V	69	2	4 877.5	3 403.0

*Thousands of gal. per day.

Oklahoma	2,500,000	+ 300,000	0.9	
Pennsylvania	40,000	0	1.4	
Texas	60,000	+ 10,000		
West Virginia	800	1,800		
Wyoming				
Others				
Total United States	4,259,300	+ 428,000	100.0	

*Data from The Oil and Gas Journal, January 28, 1952, page 213.

LEGEND

Plts. Number of natural gas processing plants.
Cap. Total capacity of plants, thousands of gal. per day.
Prod. Total liquids production 1951, thousands of gal. per day.

Supplement to The Oil and Gas Journal
Issue of May 5, 1952

IV	11	1	439.6	309.5
V	69	2	4,877.5	3,403.0
Total	477	51	34,191.1	33,648.6

*Thousands of gal. daily and includes L.P.G.

OPERATING NATURAL-GASOLINE AND CYCLING PLANTS IN THE UNITED STATES AND THEIR CAPACITIES

COMPILED 1952 BY THE OIL AND GAS JOURNAL STATISTICAL DEPARTMENT

ARKANSAS

Company and field or plant—	Approx. Cap. gal. day
Arkansas Fuel Oil Co., Columbia	90,000
Arkla Oil Co., North Rodessa	50,000
Hiwan Oil & Gas Co., Atlanta	20,000
Lion Oil Co., Shuler	35,000
Magnolia Petroleum Co., Kenova	7,200
Querbes, J. R., Oil Co., Southfield	10,000
Shell Oil Co., Magnolia	85,000
Sunray Oil Corp., Midway	30,000
Total	327,200

CALIFORNIA

Company and field or plant—	Approx. Cap. gal. day
Bankline Oil Co., Signal Hill	17,000
Beiridge Oil Co., North Beiridge	90,000
Brea Canyon Oil Co., Brea-Olinda	10,000
Coline Gasoline Co., Rincon	50,000
Continental Oil Co., Ventura	45,500
Cowan Oil & Rel. Co., Rosecrans	10,000
Fullerton Oil Co., Huntington Beach	40,000
General Petroleum Corp., Athens, Helm, Riverdale-Lanare, Santa Fe Springs, Ventura, Wilmington	505,000
Honolulu Oil Corp., Buena Vista Hills, Cymric	75,000
Inglewood Gasoline Corp., Potrero	5,500
Lomita Gasoline Co., Signal Hill	130,000
Magruder, P. S., Operator, Kettleman Hills (2 plants)	255,000
Naval Pet Reserve No. 1 (Unit Operation Standard Oil of Calif.), Elk Hills	5,000
Norwalk Co., Maricopa-Sunset, Santa Fe Springs, Ventura, Wilmington	32,500
Rice Ranch Oil Co., Orcutt	2,800
Richfield Oil Corp., North Coles Levee, Russell Ranch, South Cuyama	399,000
Shell Oil Co., Brea, Capitan, Dominguez, Signal Hill, Santa Maria, Ten Section, Ventura	390,100
Signal Oil & Gas Co., Elwood, Huntington Beach, Signal Hill	300,000
Standard Oil Co. of California, Greeley, Huntington Beach, Inglewood, Kettleman Hills (3 plants), Lost Hills, Midway (3 plants), Murphy-Coyote, Mountain View, Northeast Coalinga, Santa Fe Springs, Seal Beach, Torrance	834,000
Sunray Oil Corp., Newhall	50,000
Superior Oil Co., Rio Bravo	100,000
Texas Co., Santa Fe Springs, Signal Hill, Shiells Canyon	161,100
Tide Water Associated Oil Co., Ventura Ave.	150,000
Union Oil Co., Brea, Coalinga Nose, Del Valle, Dominguez, Orcutt, Playa del Rey, Richfield, Rosecrans, Santa Fe Springs, Santa Maria	[illegible]
West Coast Refining Co., Richfield	50,000
Wilmington Gasoline Co., Terminal Island	105,000
Total	4,181,500

COLORADO

Company and field or plant—	Approx. Cap. gal. day
California Co., The, Rangely	68,000

ILLINOIS

Company and field or plant—	Approx. Cap. gal. day
Arkansas Fuel Oil Co., Robinson	500
Brenneman & MacDowell, Condry (2 plants)	1,250
Carter Oil Co., Louden	74,000
Engle Petroleum, Inc., Benton	10,000
Texas Co., Hoodville, Salem	245,300
Warren Petroleum Corp., Crossville, Salem	120,000
Total	451,050

KANSAS

Company and field or plant—	Approx. Cap. gal. day
Cities Service Oil Co. (Del.), Main Line (2 plants), Burrton	148,000
Colorado Interstate Gas Co., Hugoton	40,000
Dearfield Petroleum, Inc., Hugoton	25,000
Flynn Oil Co., Otis	330
Kansas P. & L. Co., Medicine Lodge	30,000
Magnolia Petroleum Co., Nichols	78,000
Northern Natural Gas Co., Hugoton	65,000
Panhandle Eastern Pipe Line Co., Hugoton	110,000
Skelly Oil Co., Cunningham	15,000
Stanolind Oil & Gas Co., Hugoton	283,000
Sunray Oil Corp., Rainbow Bend	3,000
Texas Co., Atlanta	7,400
Total	804,930

KENTUCKY

Company and field or plant—	Approx. Cap. gal. day
Ashland Oil & Refining Co., Fixer, Lee	2,000
Kentucky West Virginia Gas Co., E. Ky., Boyd	4,000
Tennessee Gas Transmission Corp., Gabe (Main Line)	380,000
United Fuel Gas Co., Leach plant, Warfield plant	95,000
Total	481,000

LOUISIANA

Company and field or plant—	Approx. Cap. gal. day
Anchor Gasoline Corp., Eola, Pine Prairie, Chenoyville, North Tepetate	79,000
Anse La Butte Gasoline Co., Anse La Butte	12,000
Arkansas Fuel Oil Co., Bisteneau, Langston, North Ruston, Rodessa, Shreveport, Sligo	121,900
Atlantic Refining Co., Neslo	62,740
California Co., Hico Knowles	142,800
Carter Oil Co., Stiles	5,000
Claiborne Gasoline Co., Lisbon	150,000
Colleco Corp., Rodessa	50,000
Continental Oil Co., Gillis, Tepetate, Ville Platte	124,000
Great National Oil Corp. of Louisiana, Ida	35,000
Gulf Refining Co., Homer	10,000
Humble Oil & Refining Co., St. Landry	126,000
Hunt Oil Co., Lisbon	70,000
Magnolia Petroleum Co., Mamou	23,000
Ohio Oil Co., Haynesville	3,000
Shell Oil Co., Iowa	5,000
Stanolind Oil & Gas Co., Pine Island	4,000
Sun Oil Co., Delhi	82,000
Sunray Oil Corp., West Tepetate	35,000
Texas Co., The, Lafitte	14,000
United Gas Pipe Line Co., Koran plant, Myrtle plant, Sugar Creek	88,000
Total	1,272,440

MICHIGAN

Company and field or plant—	Approx. Cap. gal. day
Sun Oil Co., Kimball Lake	5,000

MISSISSIPPI

Company and field or plant—	Approx. Cap. gal. day
California Co., Brookhaven	18,850

MONTANA

Company and field or plant—	Approx. Cap. gal. day
Union Oil Co. of California, Cut Bank	30,000

NEBRASKA

Company and field or plant—	Approx. Cap. gal. day
Ohio Oil Co., Huntsman	36,000

NEW MEXICO

Company and field or plant—	Approx. Cap. gal. day
El Paso Natural Gas Co., Plants 1, 2 and 3, San Juan	170,900
Frontier Natural Gasoline Co., Grayburg-Jackson	30,000
Gulf Oil Corp., Drinkard	126,000
Mallamar Corp., Mallamar	24,000
Phillips Petroleum Co., Eumice, Hobbs	161,000
Skelly Oil Co., Eumice (2 plants)	140,000
Southern Union Gas Co., Fulcher-Kutz	21,000
Valley Gas Corp., Loco Hills	12,000
Warren Petroleum Corp., Monument, Lea	75,000
Total	783,900

OHIO

Company and field or plant—	Approx. Cap. gal. day
East Ohio Gas Co., Cuyahoga	2,550
Ohio Fuel Gas Co., Northern Medina, Sugar Grove	10,000
River Gas Co., Ludlow	4,000
Total	16,550

OKLAHOMA

Company and field or plant—	Approx. Cap. gal. day
Apache Gasoline Co., Apache, W. Brock	35,000
Barksdale Co., Barksdale, Hughes	500
Carter Oil Co., Flitt, Seminole, Cromwell	185,600
Cities Service Oil Co. (Del.), Oklahoma City, Guymon, Tallant	98,000
Continental Oil Co., Billings, Tonkawa	25,000
Devonian Oil Co., Kellyville	20,000
Eason Oil Co., Crescent	40,000
Frame Natural Gasoline Co., Pawnee	2,000
Grimes Gasoline Co., Wetumka, Coon Creek	25,000
Grimes, Chas. W. and Otha H., Okemah, Welcetka	13,000
Grimes, Otha H., Pauls Valley	20,000
Otha H. Grimes and Roy O. Neal, Drumright	3,500
Gulf Oil Corp., Kiefer, Mission	38,000
Keener Oil Co., Custer	45,000
Kerr-McGee Oil Industries, Inc. (operator), Flitt, Happy Valley, Milfay	80,000
Lone Star Gas Co., Hollis, Kelly	40,000
Magnolia Pet. Co., Davenport, Graham, St. Louis, Sholem Alechem	133,000
Mid-Continent Petroleum Corp., Cromwell, Sawyer, Stillwater, Prague, Moore	48,500
Neal Gasoline Co., Osage	5,200
Panoma Corp., Guymon-Hugoton	110,000
Patton & Swab Inc., Edmond	6,000
Phillips Petroleum Co., Burbank (2 plants), Edmond (2 plants), Oklahoma City, Wewoka	347,000
Pioneer Corp., Bixby	1,000
Pure Oil Co., Glenn Pool, Creek	6,000
Shell Oil Co., Hewitt	24,000
Sinclair Oil & Gas Co., Covington, Drumright, Seminole (2 plants), Shamrock, St. Louis	475,000
Skelly Oil Co., Burbank (3 plants), Velma	150,000
Sunray Oil Corp., Avant, Seminole-Earlsboro	90,000
Texas Co., Davenport, E. More, Blackbird	34,900
Universal Gasoline Co., Aylesworth	5,800
Warren Petroleum Corp., Madill, Maud, Mayesville, Ringwood	535,000
Total	2,517,500

PENNSYLVANIA

Company and field or plant	Approx. Cap. gal. day
Bayliss & Bayliss, Titusville	10,000
Clinger Oil & Gas Co., Tidioute (2 plants)	2,000
Crawford & Gregory, Venango	140
Ellenburger, W. J., & Sons, Karns City	300
Equitable Gas Co., Rogersville	10,000
Haskell, Roth & Bayliss, Tidioute	10,000
Mars Co., Lewis Run, Pinegrove, Van	20,000
Pennsylvania Oil Co., Sheffield	10,000
Peoples Natural Gas Co., Brave	20,000
Quaker State Oil Refining Co., McDonald	2,500
Surety Oil Co., Tiona, Titusville, Trueman's Forrest	1,650
Warner-Caldwell Oil Co., Titusville	1,000
Total	87,590

TEXAS

Company and field or plant	Approx. Cap. gal. day
Abercrombie Co., J. S., Old Ocean	320,000
Amarillo Oil Co., Panhandle	12,500
American Republics Corp., Silsbee, Joo's Lake	122,000
Anchor Gasoline Corp., Tex-Harvey	100,000
Anzak Oil Corp., Overall	300
Arkansas Fuel Oil Co., Carthege, Panola, East Texas, Smithland, Rodessa, Waskom	484,000
Atlantic Refining Co., Block 31	21,000
Bernhart Hydrocarbon Corp., Barnhart	90,000
Bennett O. & R. Co., of Texas, Mission River	15,000
Breckenridge Gasoline Co., Ellesville, Rodessa	48,000
Cabot Carbon Co., Estes, Walton, Keystone	109,000
Canadian River Gas Co., West Panhandle	50,000
Carthage Corp., Carthage	417,300
Caska Corp., Quitman	13,000
Chicago Corp., Carthage	215,000
Cities Service Oil Co. (Del.), Chico, Pampa	105,000
Colorado Interstate Gas Co., W. Panhandle	55,000
Colleco Corp., Panhandle	50,000
Columbian Gasoline Corp., Wheeler	25,000
Consolidated Gasoline Co., Cisco	8,000
Continental Oil Co., K.M.A., Rincon, Todd Ranch, Slick-Wilcox	258,100
Del Rey Petroleum Co., Chesterville	60,000
Duval Gasoline Co., Benavides (2 plants)	10,800
El Paso Natural Gas Co., Sealy-Smith	47,100
E. Texas Prod. Gas, Chapel Hill	20,000
Fullerton Oil Co., Fullerton	120,000
Gregg-Tex Gasoline Corp., E. Texas	135,000
Grimes, Otha H., Eskota	8,000
Gulf Oil Corp., E. Texas (2 plants), North Ward-Estes, Sand Hills	227,000
Henderson Trust No. 2, W. Panhandle	40,000
Hilander Gasoline Co., Rogers	12,000
Huber, J. M., Corp., Panhandle	22,000
Humble Oil & Refining Co., Amaluse, Clear Lake, Conroe, East Texas, Flour Bluff, Heyser, Jourdanton, Pickton, Tomball, Tom O'Connor	707,400
H. L. Hunt, Harleton	50,000
Ibex Co., Ibex	9,000
La Gloria Corp., La Gloria	50,000
Lion Oil Co., Diamond M, Sharon Ridge	315,000
Lone Star Producing Co., Brooks, Eastland (fract. plant), Eastland, Stephens	160,000
Lyman, C. V., Gasoline Co., Emperor	10,000
Magnolia Petroleum Co., Burkburnett, Desdemona, Electra, Kermit, Olden, Sabine, Vanderbilt	199,500
Manning, Fred M., McKnight	6,000
McCarthy Chemical Co., Stonewall-Jackson Pasture (2 plants)	380,000
Mid-Co Gasoline Co., Cayuga	5,000
Midland Gasoline Co., Conroe	90,000
Moncrief, W. A., & Sons, Wichita-K.M.A.	6,000
Nash Gasoline Co., James, South Bend	12,000
Natural Gasoline Corp., Hawkins	100,000
Natural Gas Pipe Line Co. of America, Panhandle (2 plants)	190,000
Nine Oaks Gasoline Co., Gladewater	700
Nueces Corp., Agua Dulce	240
Odessa Natural Gasoline Co., Foster	60,000
Padre Petroleum Co., Rising Star	10,000
Panhandle Producing & Refining Co., Bryson	900
Panoma Corp., W. Panhandle	131,000
Parade Co., East Texas	175,000
Perkins Co., Burkburnett	2,000
Prewitt, P. H., Joaquin, Shelby	2,000
Phillips Petroleum Co., Bowers, Canadian, McElroy, Dumas, Fullerton, Goldsmith, Gray, Hansford, Judkins-Harper, K.M.A., Lefors, North, Pampa, Panlex, Rock Creek, Sanford, Seminole, Sherman, Sneed, Chocolate Bayou	1,757,000
Pioneer Gasoline Co., Pioneer	3,000
Plymouth Oil Co., Benedum, Plymouth	370,000
Portland Gasoline Co., Panhandle, Gray	55,000
Pure Oil Co., Dollerhide, Van	250,000
Reno Oil Co., Reno-Strawn	4,500
Sid Richardson Gasoline Co., Keystone	150,000
Roeser & Pendleton, Plant 1, Plant 4	7,000
Rudco Oil & Gas Co., Rising Star	2,250
St. Marys Oil & Gas Co., Colony, Moran	40,000
Shamrock Oil & Gas Corp., Panhandle	400,000
Shell Oil Co., Panhandle (2 plants), Provident City, T-X-L, Wasson	879,000
Sinclair Oil & Gas Co., Longview, Taft, Troup (2 plants)	485,000
Skelly Oil Co., Burkburnett, Carson (2 plants)	263,500
Southern Minerals Corp., Sweet, Stratton	65,000
Southern Prod. Co., Pledger	30,000
Standard Oil of Texas, Bivells Bend, Scurry	147,000
Stanolind Oil & Gas Co., Hastings, La Rosa, Levelland, Luby, North Cowden, Slaughter, South Fullerton	994,000
Sun Oil Co., Jameson, Sun	150,000
Sunray Oil Corp., Snyder	525,000
Texas Co. (Operator), Chalk Hill	12,350
Texas Co., Electra, Wichita	23,000
Texas Gas Products Corp., Benedum	300,000
Texas Natural Gasoline Corp., Santa Rosa, Walnut Bend, Wimberly	180,000
Texas Pacific Coal & Oil Co., Caddo	19,000
Tex-Harvey Gasoline Plant, Inc., Tex-Harvey	200,000
Tide Water Asso. Oil Co., Long Lake, Cayuga, Sublime, South Blinton, Yoward	102,300
United Gas Pipe Line Co., Agua Dulce, Carthage, Karnes City	499,000
Waggoner, W. T., estate, Waggoner	7,000
Warren Petroleum Corp., Breckenridge, Fairbanks, East Texas, Holliday, McLean, Madden	440,000
West Gasoline Co., Hull	13,000
West Texas Gasoline Co., W. Panhandle	30,000
Total	14,471,240

WEST VIRGINIA

Company and field or plant—	Approx. Cap. gal. day
Carnegie Natural Gas (entire holdings)	735
Falling Rock Channel Coal Co., Falling Rock	3,000
Hope Natural Gas Co., Cornwell, Hastings, Kennedy, Waverly	270,000
Manufacturers Light & Heat Co., Reader, Proctor	13,000
Owens, Libby-Owens Gas Dept., Kenawa	10,000
Pure Oil Co., Cabin Creek	7,000
Quaker State Oil Refining Corp., Wetzel (2 plants)	8,750
South Penn Natural Gas Co., Bennett, Blackshere, Broadwater, Clay, Coldwater, Copley, Edgell, Fairview, Griffith, Hartley-Stephens, Liverpool, Lynch, McElroy, Metz, Morgan, Oil Siding, Pine Grove, Prutny, Rock Creek, Seckman, Shinnston, Stringtown, Sweeney, Tanner, Victor, Wood	40,200
United Fuel Gas Co., Cobb plant, Elk plant, Ferrell plant, Hubbell plant, Ona plant, Sandyville plant	151,500
Total	504,200

WYOMING

Company and field or plant—	Approx. Cap. gal. day
Continental Oil Co., Lance Creek	65,000
Mountain Fuel Supply Co., Church Buttes	21,000
Northern Utilities Co., Sand Draw	2,500
Ohio Oil Co., Grass Creek, Rock River	11,100
Pure Oil Co., Worland	50,000
Sinclair Oil & Gas Co., Lost Soldier	15,000
Stanolind Oil & Gas Co., Salt Creek, Elk Basin	149,500
Total	314,600

CYCLING PLANTS

ARKANSAS

Company and field or plant—	Approx. Cap. gal. day
McKamie Gas Cleaning Co., McKamie	18,500

CALIFORNIA

Company and field or plant—	Approx. Cap. gal. day
Ohio Oil Co. (Operator), South Coles Levee	284,000
Western Gulf Oil Co. (Operator), Paloma	412,000
Total	696,000

COLORADO

Company and field or plant—	Approx. Cap. gal. day
Continental Oil Co., McCallum	27,000

LOUISIANA

Company and field or plant—	Approx. Cap. gal. day
Acadia Corp., Egan	128,000
California Co., The, Lake St. John	173,140
Cotton Valley Operators Comm., Cotton Valley	420,000
Haynesville Operators Comm., Haynesville	65,000
Southwest-Feazel, Dubach	100,000
Stanolind Oil & Gas Co., South Jennings	50,000
Sunray Oil Corp., Benton	210,000
Texas Co., The, Operator, Erath, Bateman Lake	750,350
Total	1,915,490

MISSISSIPPI

Company and field or plant—	Approx. Cap. gal. day
California Co., The, Cranfield	107,100

OKLAHOMA

Company and field or plant—	Approx. Cap. gal. day
Magnolia Petroleum Co., Chitwood	57,000
Shell Oil Co., Elk City	275,000
Total	332,000

TEXAS

Company and field or plant—	Approx. Cap. gal. day
Agua Dulce Co., Agua Dulce	60,000
American Liberty Oil Co., Blessing	25,000
American Republics, Silsbee	135,000
Anco Gas Corp., Long Lake	15,000
Atlantic Refining Co.	21,000
Big Lake Oil Co., Big Lake	80,000
Chicago Corp., Stratton-Agua Dulce (3 plants)	486,400
Dist. Prod. Corp., North Houston	51,500
Federal O. & G. Industries, Inc., Joyce Richardson	8,400
Francites Gas Co., Francites	40,000
Gasoline Production Corp.	65,000
Geier-Jackson, Inc., Grapeland	80,000
Gillring Oil Co., Agua Dulce	40,000
Gray-Wolfe Co., Pinehurst	30,000
Harrell, H. M., Ehrhardt	40,000
Humble Oil & Refining Co., Katy	950,000
La Gloria Corp., La Gloria	330,600
Lone Star Producing Co., Opelika, Carthage, Chapel Hill	300,000
Magnolia Petroleum Co., Seeligson	900,000
Plomo Co., Brayton	45,000
Roeser & Pendleton, Cayuga	2,000
Shell Oil Co., Sheridan	200,000
Standard Oil Co. of Texas	73,500
Stanolind Oil & Gas Co., Burnell-North Petlus	287,000
Superior Oil Co., Lake Creek (3 plants)	950,000
Taylor Refining Co., McAllen	180,400
Tidewater Associated Oil Co., Cayuga, Long Lake	70,000
Trinity Gas Corp., Sejita	75,000
Wescol Oil & Gas Co., Nordheim	180,000
Western Natural Gas Co., San Salvador	90,000
Total	4,878,400

Underground Storage Facilities

(Continued from page 221)

common practice and if truck facilities are operated in conjunction it may take an attendant on each tour. Or if living accommodations are available one or two men may run the entire plant. The type of personnel will depend on the duties, but it is strongly recommended to have men of high caliber. Faulty operation can destroy the storage and the fact will not be known until accounts are checked at the end of the year.

10. **Safety.**—The hazards of storing butane and propane in steel tanks are known to all. When tanks rupture, disastrous fires are more than likely to occur. Even a ruptured line is usually the starting of a serious fire. However, these hazards do not exist when using underground storage.

If a tap into the annulus where hydrocarbons are stored is ruptured, liquid will flow out until the column of salt water falls enough to be balanced by the hydrocarbons in the annulus. Then liquid will stop flowing and gas will escape at the rate it is released from the exposed surface until the liquid stored temperature is lowered sufficiently. In a very short time there will only be a little gas escaping. The remainder of the liquid will lie dormant for days or until temprorary shutoffs are installed and permanent repairs made. The amount of gas escaping is in proportion to heat available to vaporizing the liquid.

All in all, underground storage is the safest available.

Producing and Gathering High-Pressure Gas

(Continued from page 189)

which must be studied to decide upon the most advantageous nature to approach the problem.

When any field system is installed, safety should be one of the prime considerations. If the plant and field lines are designed to operate at 1,800 psi. and shut-in pressure at the well head is 2,500 psi., it is probably more economical to design the entire system for a 2,500-psi. operating pressure. In case of an emergency shutdown to the plant, or in case of any line stoppage due to hydrate formation, all sections of the line would withstand the full well pressure. However, another problem presents itself in operating a low-pressure line when the deliverability and shut-in pressure of certain wells which produce into the low-pressure lines are greatly different. Take as an example a 500-psi. gathering line; the shut-in pressure on part of the wells feeding into this system is low, which requires that the gas be compressed, but at the same time there may be one or two high-pressure wells with low deliverability which must be produced into this low-pressure system in order to meet their allowable. In case of an emergency shutdown at the plant or line stoppage the high-pressure well with the low deliverability could eventually pressure this line up to a very high pressure. However, from a cost standpoint, it would be uneconomical to install a line capable of withstanding 2,500 psi. when the normal operating pressure of the line would only be 500 psi.

Among several safety devices, which could be used in the foregoing case, would be high-pressure shutoff controls on each well. In case of line stoppage, these controls would be set to shut off each well when the pressure increased to the control point, then preventing gas from the high pressure wells from feeding into the line. This line could also be protected with relief valves or safety heads. Relief valves have not proven too satisfactory on the higher pressure lines due to formation of hydrates when the valve is open, which prevents the valves from closing when the pressure drops below the set point. However, on the lower-pressure lines, they will prove of considerable value.

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Hunter & Hunter
Marion, Texas
TGT
Jefferson, Texas

1947
Warren
Fairbanks, Texas
TGT & Gulf States
San Salvador, Texas
Pan American
Houston, Texas
Gray Wolfe
Pinehurst, Texas

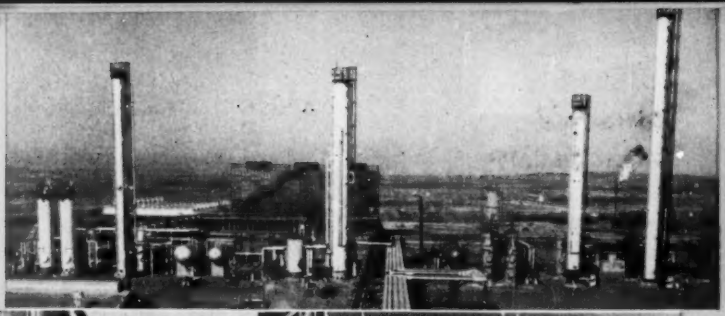
1948
Warren
Fairbanks, Texas
Lion
Shuler, Arkansas
Wehlu
Edmond, Oklahoma
Warren
Mobile, Alabama
Gulf
Kiefer, Oklahoma
Barnsdall
McFaddin, Texas

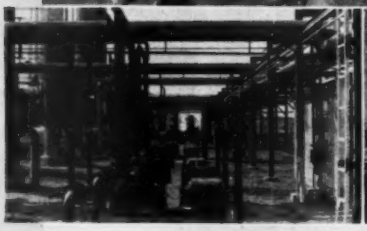
1949
Texas Co.
Archer City, Texas
Lion
Shuler, Arkansas
Barnsdall & Sterling
Bloomington, Texas
Baldridge & King
San Pablo, Texas
Barnsdall
Placedo, Texas
Reno Oil Co.
Geraldine, Texas

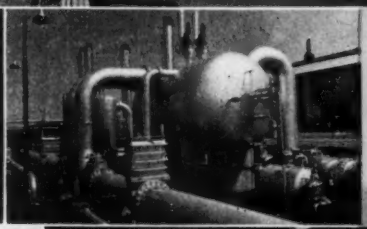
1950
Del Rey
Chantersville, Texas
Humble
South Mayes, Texas
General Crude
Dayton, Texas
Mid-Valley
Clarkson, Ky.
Pecos
Orla, Texas

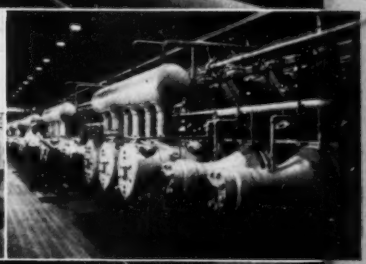
1951
Pan American Production
Willamar, Texas
TGT
East Bernard, Texas
Del Rey
Chantersville, Texas
General Crude
Dayton, Texas
Texas Co.
Searcy County, Texas
Sunray
Placedo, Texas

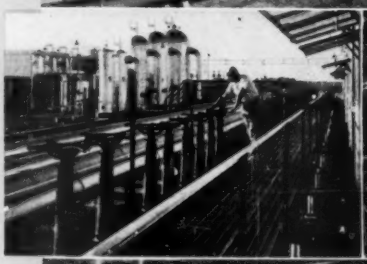
1952
Mid-Valley
Clarkson, Ky.
El Paso Natural Gas Co.
Orla, Texas
Shell
Cohiba, Texas
Texas Co.
Searcy County, Texas
General Crude
Clairemont, Texas
TGT
East Bernard, Texas
TGT
Victoria, Texas
Del Rey
Chantersville, Texas

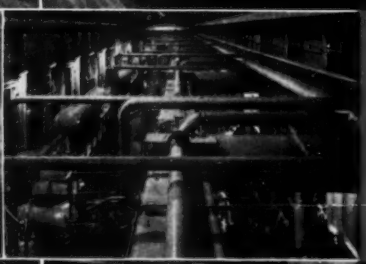


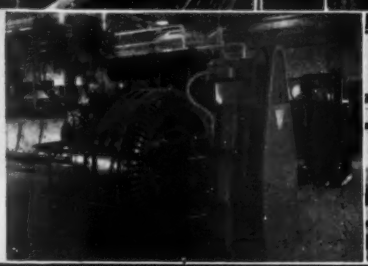


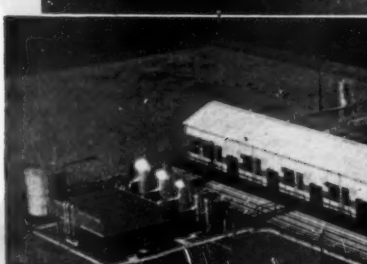












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READY FOR OPERATION.—View of trailer-mounted rig in place. Note slush pump and engine drive for standby unit resting on extension at right.

Easy to Move

Here's a new-type substructure for trailer rigs which saves rigging-up, and tearing-down time, and is easy to move

MAJOR time savings in rigging up and tearing-down operations, coupled with easy mobility, are features of the new-type substructure for trailer rigs.

The substructure can be adapted to any trailer rig, and the trailer may be removed with minimum effort.

The substructure is designed primarily for shallow drilling to depths of 5,000 ft., and for workover operations for depths of from 10,000 to 11,000 ft.

It is available in 5 ft., 7 ft., or 9-ft. heights and can accommodate 87 ft., 96 ft., or 126-ft. cantilever masts. It was designed for shallow drilling and workovers where frequent moves are required.

Features.—The substructure consists of two main side frames with a rotary-table support and a pipe setback support which is provided at the front of the structure. These supports are joined with 1½ or 2-in. drive pins. To support the trailer, two ramps are mounted to the substructure. These extend into the structure to a point just behind the center of the well. Ramp extensions are provided for easy installation.

In operation, the trailer is backed into the substructure until the rear of the trailer extends over a support beam which is behind the well. The ramps remain in place and support the trailer-mounted rig.

The front of the trailer is raised by means of jacks until the trailer frame is flush with the floor of the substructure. In so doing, the trailer is supported by the beam and the load taken off of the wheels. After this step, two additional 12-in. I-beams are installed transverse across the substructure to support the trailer completely. At this stage the rig is ready for operation.

The purpose of the three I-beams is to take the load off the truck tires and transfer it to the substructure, thereby making the trailer an integral part of the substructure.

Draw works.—The draw works is mounted on the trailer, and is driven by a diesel engine. An extension of the substructure mounts a slush pump driven by an internal combustion engine.

To tear down, the following steps are made: (1) Remove two I-beams, (2) lower jacks to return trailer to normal position on ramps, (3) pull trailer off of ramp, (4) dismount ramp extensions, and (5) dismount side frames from rotary-table support for loading.

The mast and substructure, drawworks, engines, side frames, and rotary-table support can be hauled easily on four trucks.

The first unit was constructed during February, 1952 and was purchased by the contracting firm of Thompson and Boaz of Odessa, Tex. Lee C. Moore Corp., Tulsa, is the designer of the new units.

Shell Increases Range of Its Shoran Equipment

Shell Oil Co. has increased the effective range of its Shoran equipment from a 35-mile semicircle to a distance of 55 miles by recent purchase of three 198-ft. portable aluminum stairs-type Shoran towers (see picture at right). Previous masts were 96 ft. high, keeping effective distance down to 35 miles.

Shoran is a form of radar equipment developed during World War II, as a means of guiding aircraft automatically to precise positions for bomb releasing. Shell uses Shoran in lower Texas for Gulf Coast offshore seismic-exploration work.

"Shoran" is an abbrevation of short-range-navigation. Two fixed stations, Island and Riviera Beach, are 40 miles apart. They are used for operation of the equipment. Impulses are received at these points from a transmitter on the mobile unit, the "Edna S.," one of the boats used by the company in the operation.

Impulses transmitted from the ship are amplified and retransmitted by the two shore stations to the boat where Shoran apparatus measures time required for impulses to travel the distance from the boat to each shore station and back again.

The apparatus on the boat computes from this measurement the distance from ship to shore. Geophysical boats always know their exact location by using Shoran. Boats may go to shore and return the next day to precisely the same spot. Seismic shot points are recorded and plotted within 50-100 ft. of accuracy.

Erection time requires only 1 day for a complete tower of this type, using a crew of eight men. The port-

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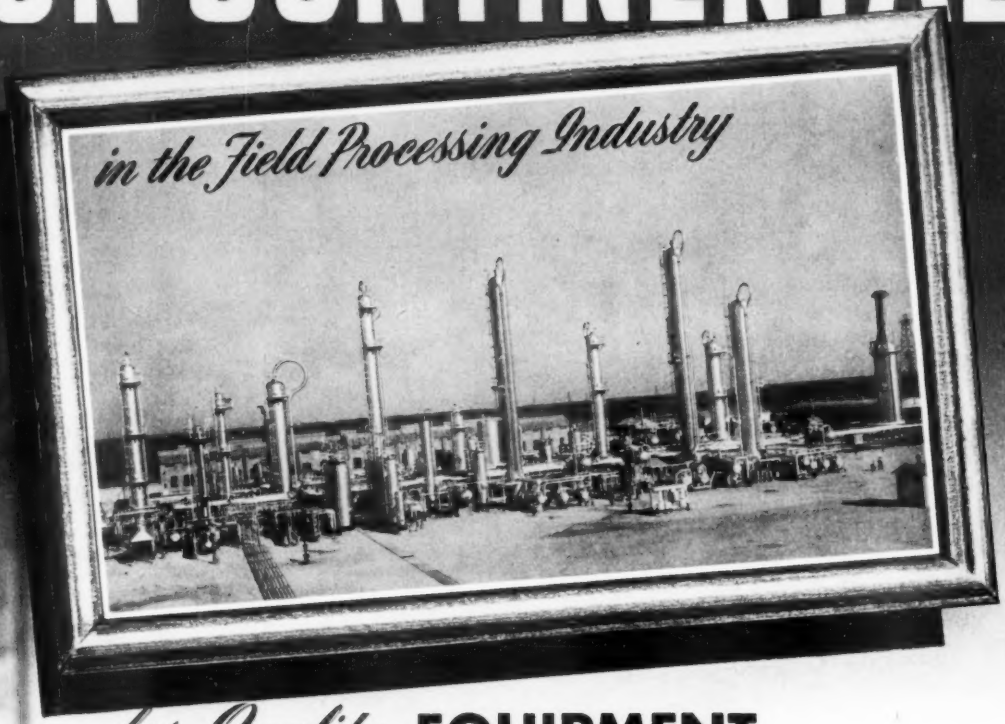

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able towers are divided into sections which unfold from a 7-in. flat package to a 6-ft. high stairway section weighing less than 78 lb. No nuts or bolts are used in the tower, and a section does not come any further apart than shown in the photograph, being built complete as one piece.

Tank Stores, Recirculates Water for Engine Brakes

A large rectangular steel tank is being used successfully by Richfield Oil Corp. in South Coles Levee, Calif., as a storage and recirculating tank for water pumped through the hydromatic and water-cooled brakes.

Adequate cooling is obtained by placing a flat piece of tank steel over the grated cover of the tank to distribute the discharge from the units

over an area wide enough that the temperature is reduced sufficiently for recirculation.

The outlet of the hose returning the water to the tank from the operating equipment is equipped with an ell and a short nipple trimmed so that three legs provide an open space between the solid nipple and the splash plate to which the legs are tack welded.

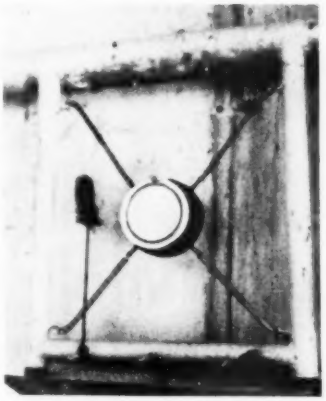
The slots between the legs break the water into an even sheet so that a finely divided spray drops into the tank below. This apparatus has been in use for a number of months and has been found adequate for the purpose.

Where water is to be treated, the loss of windage is insignificant and makeup is necessary only at wide intervals.

Shockproof Mount for Timer Designed by Richfield Oil

The timing clock used by Richfield Oil Corp. on one of its heavy rigs operating at North Coles Levee, Calif., is mounted in a bracket besides the mud-testing apparatus with four coil springs to prevent damage to the timepiece by shock and vibration.

The bracket consists of three short 2-in. pipe nipples attached to the frame of the testing apparatus, by



TIMER is mounted on springs.

welding. At each of the four corners of this rectangular frame is a hook into which one end of the helical spring is placed, while the opposite end is connected to a pin connected to the case of the timepiece.

The tension of all four springs holds the clock in the open center of the bracket where the force of any shock is absorbed by the springs before it reaches the timer. Protection is also provided with a narrow shield above the bracket to divert mud spray or falling objects from the timer.

Use of High-Pressure Hose Cuts Down Stringing Time

McAteer Drilling Co., Los Angeles, has found that high-pressure hose takes less time to string from fuel source to the engines than common pipe.

To provide the greatest amount of flexibility when making these connections, the company devised a manifold containing a minimum amount of connections so that individual hose might be led to various power units.

The manifold is a grouping of standard fittings with nipples supplied with lubricated plug valves carrying universal couplings for attaching the hose. The manifold can be laid flat on the ground at any point most convenient for the men when rigging up.

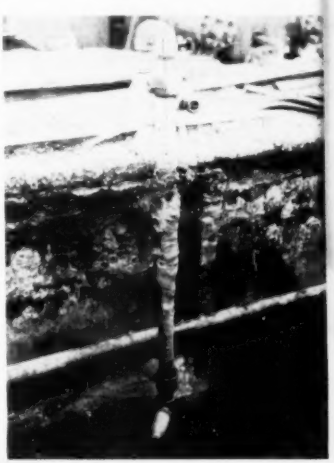
The individual hose is supplied long enough to be connected to the regulators, individual scrubbers and volume tanks without cutting or changing any of the important parts of the manifold.

Santa Maria Uses Renewable Agitation Mud-Gun Nozzles

Santa Maria Drilling Co. supplies mud under pump pressure through a header attached to the rim of the tank for jet guns equipped with packed swivels for a range of practically 180°.

Two-inch pipe is used for the vertical riser passing to the floor of the mud tank where it is retained with a ferrule attached to the side wall of the vessel.

The bottom of the riser carries a heavy-duty steel ell into which a 2 by 1 in. swedge nipple is connected.



This swedge supplies the nozzle which produces the necessary turbulence to sweep the floor of the tank and prevent sedimentation of the drilling mud.

The relatively low cost of the swedge provides for economical maintenance, and the nozzle can be replaced easily as often as necessary when the tank is pumped dry. The accompanying picture shows one side of the nozzle cut to such an extent that it now requires replacement.

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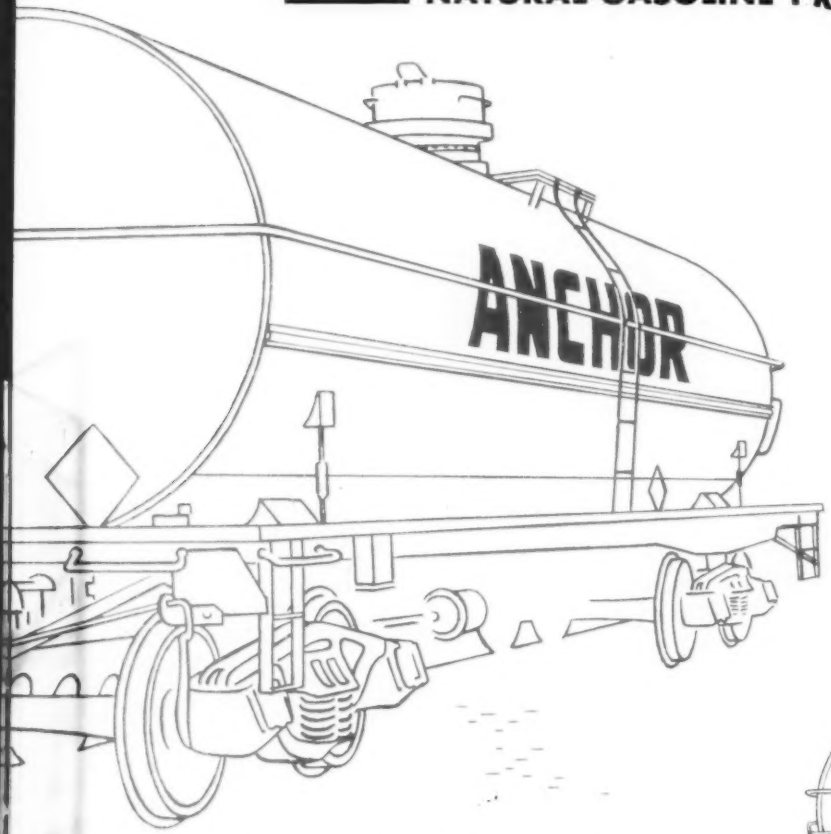

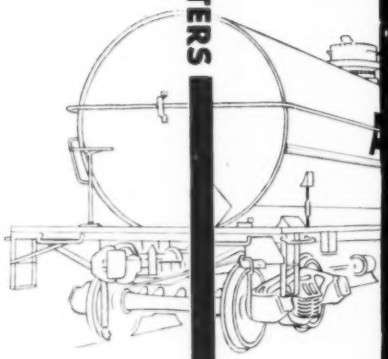

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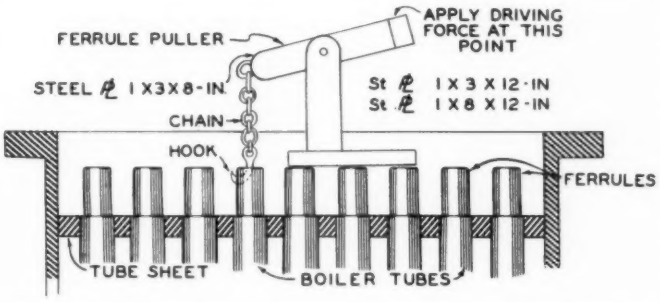

FERRULE PULLER
APPLY DRIVING FORCE AT THIS POINT
STEEL ℄ 1 X 3 X 8 - IN
St ℄ 1 X 3 X 12 - IN
St ℄ 1 X 8 X 12 - IN
CHAIN
HOOK
FERRULES
TUBE SHEET
BOILER TUBES

DIAGRAM of device for removing ferrules from ends of waste-heat boiler tubes.

Killed: A Bottleneck

Esso Standard gets rid of a bad one by development of a ferrule-removing device at its Baton Rouge, La., refinery

A BOTTLENECK on catalytic cracking-unit turnarounds has been eliminated with development of a device for removing ferrules from ends of waste heat boiler tubes at Esso Standard Oil Co.'s Baton Rouge, La., refinery.

The ferrules are installed in the ends of the tubes to protect the tube ends from corrosion and/or erosion caused by the flow of catalyst through the tubes. During the run the ferrules experience a considerable amount of damage and must be removed and replaced periodically.

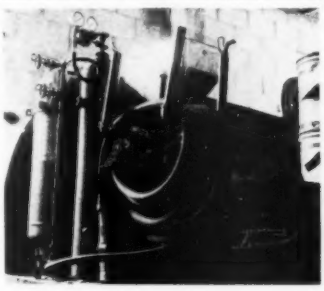
In the slow procedure originally followed, a longitudinal groove was cut in the side of each ferrule which was then collapsed and pulled out of the tube. It was necessary to clean the bundle thoroughly before proceeding to cut the groove with a torch.

Speeded up.—The operation has been speeded up considerably with the development of the pulling device, which consists of a heavy lever arm pivoted near its center and mounted on a stand. A chain and hook is attached to one end of the lever arm with a driving head being mounted on the other end.

In removing ferrules, a hole is gouged near the end and the hook which is attached to the lever arm is inserted therein.

Force is applied to the driving end by use of a riveting machine, and the resultant action removes the ferrules from the tubes.

The method was suggested by Henry J. Pogue, boilermaker.



Retainer for Extinguisher Hose Serves Dual Purpose

An extinguisher-hose retainer that serves a dual purpose is attached to a fire truck by Aurora Gasoline Co., Detroit, Mich.

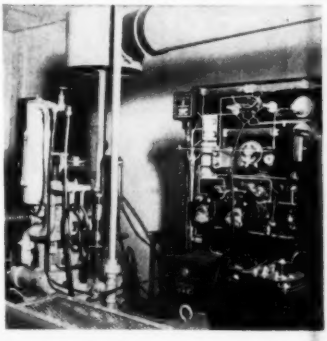
This truck is equipped with recently approved equipment, including CO_2 cylinders to supply an effective blanket of oxygen excluding vapors. A conventional fire step is at the rear of the vehicle, and the coil of hose is located where the firemen can bring it into action with the least possible delay.

A heavy bracket, containing two pipe risers is attached to the floor of the truck to bring the top ends at a point corresponding to the elbow height of men standing on fire step.

Ells and suitable-length nipples on a horizontal plane provide hanger bars upon which the hose is coiled. The outer ends of these pipe nipples are threaded to receive ells and foot-long nipples, trimmed at the free end smoothly. They may be folded against each other while the hose is coiled on the hanger.

Placed upright, the nipples form hand holds for men to grasp while riding on the truck and keep the coiled hose in the stored position. When arriving at the point of fire, the handles are flipped together, and hose uncoiled without interference.

After fire run, the hose is again coiled on the retainer, and the handles are placed upright to retain the hose and again form handholds for men returning to the fire station.



"Pressuretrol" Aids in C.F.R.-Engine Operation

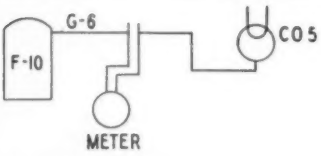
One of the problems that comes up in operation of C.F.R. engines when determining knock characteristics of motor fuels is the danger that the engine may be running without cooling water.

The operator may start the engine and forget to turn on the water, or water pressure may fail. On the other hand, the engine may be shut down without turning off the water, resulting in water waste.

At the Drumright, Okla., terminal laboratory of Sunray Pipeline Co., a system was developed by Nels J. Kirk which makes use of a Minneapolis-Honeywell "Pressuretrol." This is a pressure controller that uses a bellows to actuate a mercury switch for two-position control. This is hooked in with the motor "on" and "off" switch system so that:

1. The engine will not start until the cooling water has been turned on.
2. If water pressure fails the engine shuts off automatically.
3. When the water flow is shut off, the engine shuts down.

Danger of running the engine without cooling water is thus eliminated. Also, since the operator gets into the habit of shutting off the engine by turning off the water first, a saving in water may result.



Checking Output of Recycle Gas Compressors Simplified

Output of recycle-gas compressors can be checked by installing an orifice flange and flow meter in line between gas exchangers and compressors, according to Humble Oil & Refining Co., Houston. A second feature is that in the event a leak develops in the recycle-gas exchanger the magnitude and leak can be positively determined.

Before this installation there was no meter in the line which would accomplish these features.

An orifice flange and flow meter was installed in line G-6 (see diagram) between F-10 and the recycle gas exchanger CO-5 in order to meter discharge rate from recycle-gas compressors.

By shutting any one of the compressors down the rate of flow will be indicated by the drop in flow on the meter and the efficiency of the output of the compressor can be checked.

Rate of flow through the meter can be compared with rate of flow of recycle gas to the furnace to determine if there is leakage in the exchangers as well as determine the amount.

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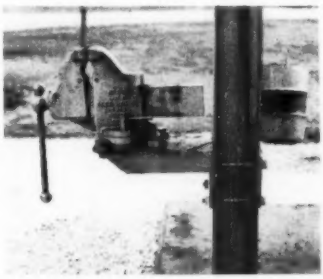


Mount for Vise Is Made of Scrap Iron, Steel Plates

A convenient mount for a vise can be made with the use of scrap channel iron and steel plates.

One steel plate is welded perpendicular to the channel and the other is used as a support for mounting the stand on a vertical beam supporting a shelter house.

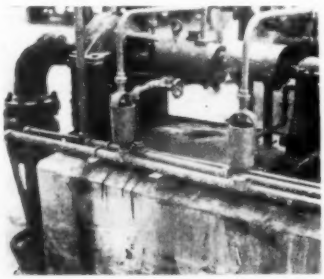
Pots Installed in Discharge Line Aids Checks on Water

Cooling-water circulation to pumps may be visually checked by installation of pots in the discharge line.

The outlet-water line from the cooling jacket is supported in a bracket welded to the top of the pots.

The operator can see the flow of water from the discharge line as it passes into the pots and then into the sewer line. Any cessation of flow will indicate difficulties in the cooling-jacket system.

The pots are merely 2-in. to 1-in. swedges which are screwed into a tee on the sewer line.



THE MAN IN THE IRON MASK

THIS man is a welder working on a new pipe-line at one of Anglo-Iranian's three oil refineries in the United Kingdom. Anglo-Iranian's refinery expansion continues on a world-wide scale. In addition to the nine refineries in Europe and Australia already operated by Anglo-Iranian and its associated companies, a new refinery in Belgium recently went on stream and another new refinery is under construction in the United Kingdom.

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Maintenance Problems Are Simplified for New Towers

Maintenance problems on the newly installed towers at Eastern States Petroleum Co.'s Houston refinery will be simplified when it comes time to make inspections and repairs.

Inverted L-members have been installed with a swivel base so that chain hoists may be mounted upon them for use in lifting tools and equipment and for use when gaining access to the upper section of the towers.

The members are simple, consisting of an I-beam appropriately supported on a length of pipe which rides in a bracket attached to the side of the tower.

Locking attachments are used to prevent hoist from sliding out of I-beam (Note square in accompanying picture).

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Crankcase Draining Speeded By Use of A Rotary Pump

Where a large number of gas engine-driven compressors are serviced periodically, the job of draining the crankcases has been reduced to a simple operation.

In one plant the oil was formerly drained from the vent into containers which were carried to drums for discarding. Now the operator simply attaches a hose to a fitting in the drain, turns a switch, and the oil is quickly pumped out through an extension hose directly into the waste-oil tank.

The unit is mounted on a two-wheeled push cart having a skid at the back immediately below a small electric motor. The rotary pump is set on a rectangular piece of tank steel bolted to the frame of the cart in line with the motor for a single V-belt drive.

Both the suction and discharge ends of the pump contain permanent matching fittings for the transfer hose for quick coupling when a unit is to be drained of worn lube oil.

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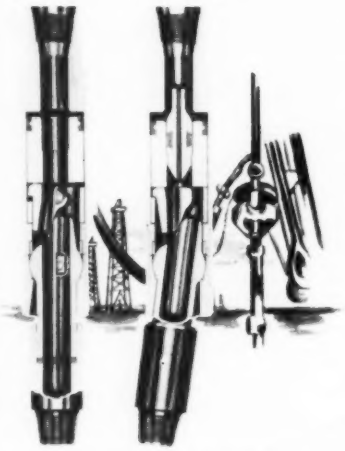

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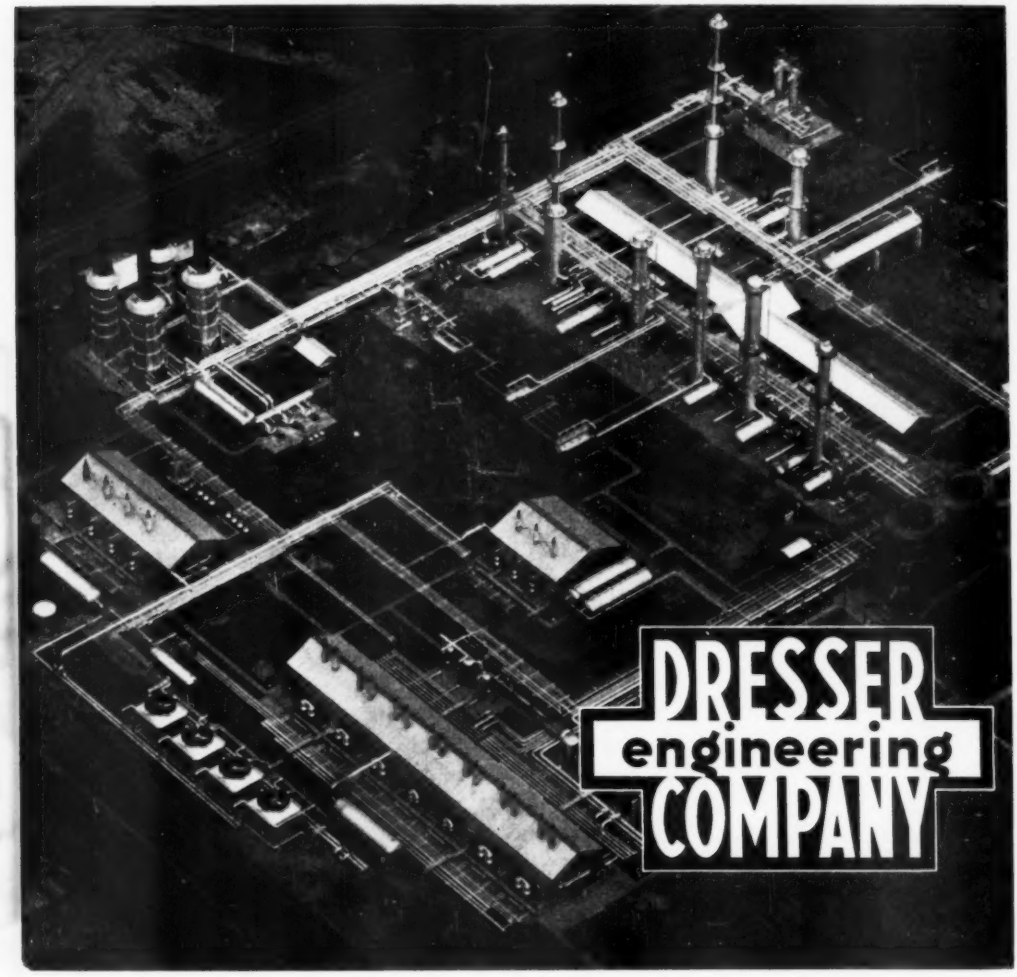

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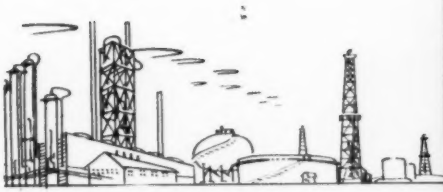


THE JOURNAL'S WEEKLY
Engineering Reference
SECTION

No. 5

PUMPS:

Part 5—Pumping Volatile Liquids

by Gerald L. Farrar
Engineering Editor

THE use of packing and lantern rings in packing and seal applications for pumps handling volatile liquids was discussed in the last installment. The subject of single mechanical seals is considered here.

Single Seals

From an operating standpoint, the mechanical seal, either single or double, offers perhaps the best solution to the seal and packing problem encountered in pumping volatile liquids with centrifugal pumps. Economically, however, it is sometimes feasible to use packing and lantern rings.

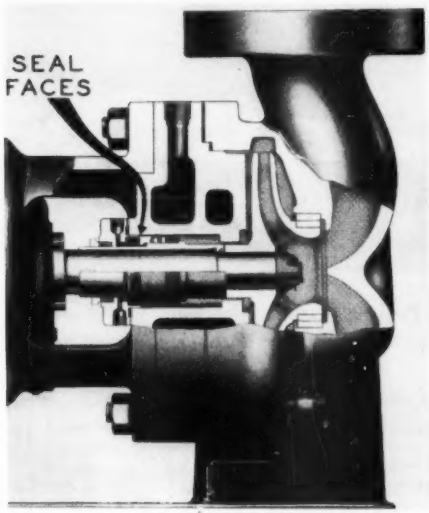


Fig. 1—The single shaft seal installed in centrifugal pump. This is a Cameron Shaft-Seal manufactured by Ingersoll-Rand Co.

Single mechanical seal.—Single mechanical seals are recommended as the best solution to the packing problems for the majority of pumps handling volatile liquids, particularly light petroleum fractions. If the pump is in high-temperature service, a small side-stream can be taken off from the discharge side of the pump, cooled, and routed through the packing box past the throat bushing and back into the pump. The seal is thus kept cool.

As shown in Fig. 1, the single seal is partially in hydraulic balance. As a consequence, the contact pressure between the sealing faces is extremely low. Thus there is little friction and wear, and long periods of trouble-free operation are assured.

The surfaces opposite the seal faces are seated against packing rings which prevent escape of fluid around the seal. The packing for the stationary ring is between the ring and packing gland, while that for the rotating ring is between the ring and a spacing collar and rests on the shaft sleeve. The packing seats allow sufficient movement so that the seal faces maintain perfect contact and alignment.

No outside lubrication is needed unless corrosive elements are present in the pumped fluid.

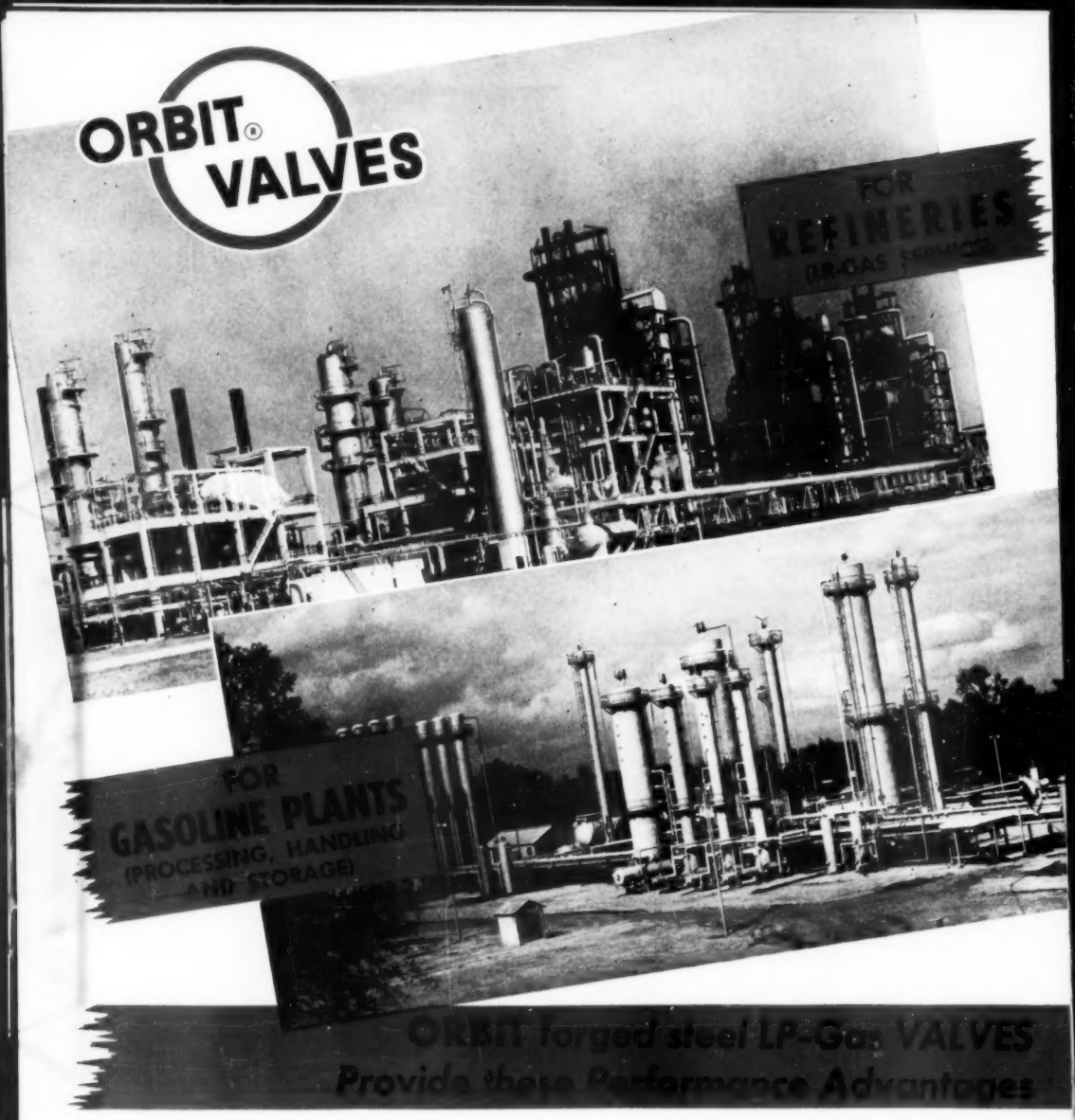
Range of operation for the single seal* and advantages of its use are as follows:

1. For hot liquids and liquids having poor lubricating qualities, stuffing-box pressures up to 400 psig. and temperatures up to 250° F.
2. Stuffing-box pressures up to 600 psig. for cold liquids having lubricating properties.
3. For liquids containing a small amount of grit the standard seal is employed and flushing liquid is brought from the pump through a strainer to the seal.

Seal advantages.—There are a number of operating advantages in the use of single seals as compared to packing. Often these turn out to be economic as well. They may be summarized as follows:

1. Once the seal is installed, it requires no further adjustment. Lower maintenance costs are a direct result, due to the elimination of frequent gland adjustment and repacking.
2. Low contact pressure between the sealing faces allows its use for high stuffing-box pressures, and for liquids having poor lubricating qualities.
3. It is suitable for use on pumps having variable loads or stuffing-box pressures.
4. No outside lubricant is needed for the single seal. Thus there is no contamination of the liquid pumped.
5. It provides a suitable method of venting gases from volatile liquids.
6. It reduces the losses which, in a conventional stuffing box, are due to leakage, friction, and recirculation from bleed-off devices.

*Conditions for the Cameron Shaft-Seal manufactured by Ingersoll-Rand Co.



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No. 121

REFINER'S NOTEBOOK

Pressure-Relieving-System Design With Variable Back Pressure

by L. P. Stillman*

THE balanced disk and sealed piston valve was illustrated and discussed in No. 114, Refiner's Notebook. This valve construction was part of a development which has gone beyond such design resulting in what may be termed a "100 per cent variable back pressure valve" whose construction is shown in Fig. 1 of this installment.

*Chairman of A.P.I. Subcommittee on Safety-Relief Valve, material from Manning, Maxwell & Moore, Bulletin No. 606, "Safety-Relief Valve for 100 Per Cent Variable Back Pressure."

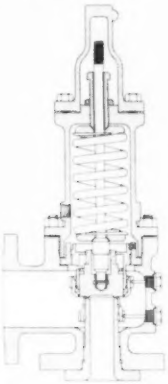


Fig. 1—One hundred per cent variable back-pressure valve.

Performance characteristics of this valve are shown at 10 per cent and 20 per cent overpressure in Figs. 2 and 3.

This valve operates on the principle of compensating flows through orifices, one orifice opening as the other closes to regulate pressure in a balancing chamber in accordance to the position of the valve disc.

This assures balancing of the disk and results in no change in set pressure when the valve is closed. It also assures lifting forces sufficient to achieve full capacity throughout the blowdown range after the valve has opened. These functions are constant regardless of back pressure conditions.

Relief system design.—One method of fitting such a valve to a pressure relieving system would be:

1. Select the set pressures of all valves discharging into the pressure relieving system. The valve with the lowest set pressure is the valve which will control the allowable back pressure in the system.

2. Knowing the requirements of the process, the maximum allowable back pressure in the system can now be chosen based on the low set valve in the system and the flow characteristics of the safety-relief valve.

3. Size the safety-relief valves using any of the methods shown in manufacturer's catalog, obtaining a tentative required orifice area.

4. Consult the performance characteristics such as shown here and find the per cent of rated capacity resulting from the allowable back pressure selected in Step 2 above.

5. Divide the tentative required orifice area determined in Step 3 by the per cent of rated capacity determined in Step 4. This will give the required orifice area to handle the required capacity through the safety-relief valve under the selected maximum allowable back pressure on the system.

6. Determine the actual orifice area and designation from the nozzle orifice area tables or charts of manufacturer's catalog.

7. Knowing the actual orifice designation, consult a selection chart and select the specific valve necessary to handle the required conditions.

8. To find the actual capacity of the valve selected, determine the capacity of this valve by any of the methods shown in the catalogs and multiply this capacity by the per cent of rated capacity found in Step 4, or determine the ratio resulting from the division of the actual orifice area of the selected valve, by the required orifice area determined in Step 5 and multiply this ratio by the required capacity of the safety-relief valve.

9. Now the line sizes throughout the system can be determined based on the quantity of vapors entering the system and their respective point of entry.

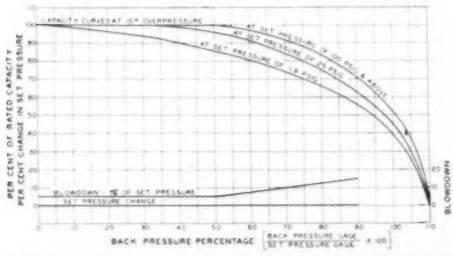

CAPACITY CURVES AT 10% OVERPRESSURE
PER CENT OF RATED CAPACITY
PER CENT CHANGE IN SET PRESSURE
BLOWDOWN
BLOWDOWN - % OF SET PRESSURE
SET PRESSURE CHANGE
BACK PRESSURE PERCENTAGE
BACK PRESSURE GAGE / SET PRESSURE GAGE X 100

Fig. 2—Capacity, change in set pressure, and blowdown at 10 per cent overpressure for safety relief valves.

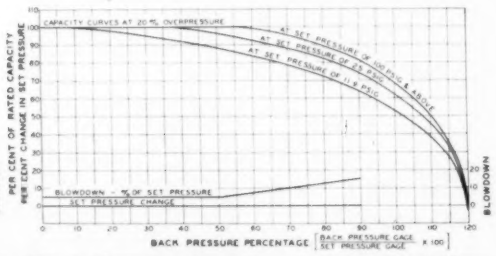
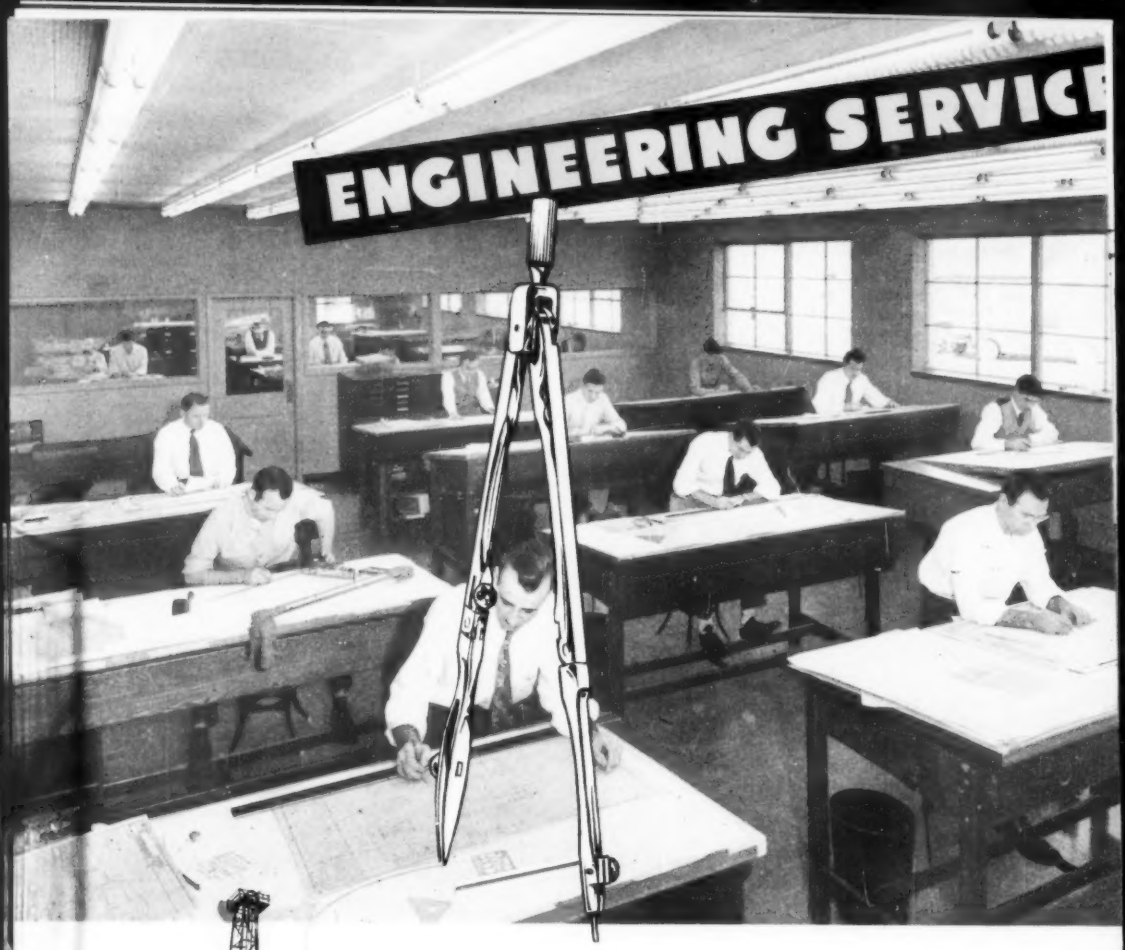
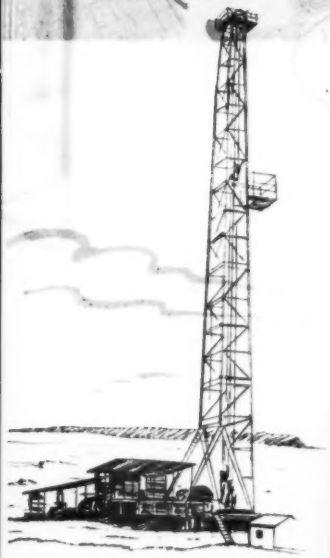

CAPACITY CURVES AT 20% OVERPRESSURE
PER CENT OF RATED CAPACITY
PER CENT CHANGE IN SET PRESSURE
BLOWDOWN
BLOWDOWN - % OF SET PRESSURE
SET PRESSURE CHANGE
BACK PRESSURE PERCENTAGE
BACK PRESSURE GAGE / SET PRESSURE GAGE X 100

Fig. 3—Capacity, change in set pressure, and blowdown at 20 per cent overpressure for safety relief valves.





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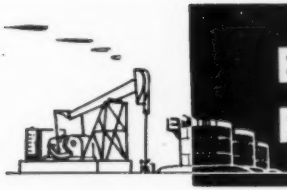

Bernoulli's Theorem

by Ralph F. Nielson*

ONE of the basic theorems of fluid dynamics is that due to Daniel Bernoulli. It is essentially a mathematical statement of the law of conservation of energy in a form convenient for application to the solution of hydrodynamical problems. In the field of petroleum engineering such problems arise in connection with gas and oil transmission, flow of gas and oil through the well tubing, flow measurements, well measurements, etc.

Bernoulli's theorem may be derived by setting up a total energy balance for a stream of fluid. For convenience, consider 1 lb. of moving gas (or liquid) at points 1 and 2 (see Fig. 1). The fluid may be moving in a conduit or it may be bounded by stream lines so that the same amount passes both points per unit time. At any point the pound of fluid will have a gravitational potential energy due to its height, and also a potential energy equal to the product of its volume and pressure. It will, in addition, have a kinetic energy due to its motion as a whole, and internal energy associated with the molecular motion.

In setting up an energy balance, the following symbols will be used:

- h = height in feet above a reference level
- u = velocity in feet per second
- U = internal energy in foot-pounds per pound
- V = specific volume in cubic feet per pound
- P = pressure in pounds per square foot
- g = acceleration due to gravity, feet per second per second

In moving from point 1 to point 2, the pound of gas may acquire an amount of heat Q (ft.-lb.) from the surroundings. If heat is lost Q is negative. Also it may have an amount of work W done on it by an outside source such as a pump or compressor. Denoting conditions at points 1 and 2 by subscripts 1 and 2, respectively, the total energy balance may be written:

$$h_1 + P_1V_1 + \frac{u_1^2}{2g} + U_1 + Q + W = h_2 + P_2V_2 + \frac{u_2^2}{2g} + U_2 \quad (1)$$

Any energy exchanges or losses due to friction with the walls or internal (viscous) friction are included somewhere among these terms.

From the first law of thermodynamics

$$U_2 - U_1 = Q - W \quad (2)$$

where w is all work done by the gas on expanding, as for instance the work of pushing gas ahead of it, minus any work done on the gas. When a gas does work by expansion, this is given by $\int P\,dV$, provided the work is done "reversibly," that is without friction and with the resisting force kept only infinitesimally less than the expansive force. Then

$$w = \int_1^2 P\,dV - \Sigma F \quad (3)$$

where such things as friction and other factors associated with lack of "reversibility" are lumped together in the term ΣF. In the flow of fluids in tubes or pipes, the internal or viscous friction included in this term is of primary importance. Making these substitutions in Equation 1,

$$h_1 + P_1V_1 + u_1^2 + \int_1^2 P\,dV + W = h_2 + P_2V_2 + u_2^2 + \Sigma F \quad (4)$$

From calculus,

$$W - \int_1^2 P\,dV + P_1V_1 - P_2V_2 = -\int_1^2 V\,dP \quad (5)$$

This substitution in Equation 4 puts it into a more usable form:

$$W - \int_1^2 V\,dP = h_2 - h_1 + \frac{u_2^2 - u_1^2}{2g} + \Sigma F \quad (6)$$

Equation 6 is one form of Bernoulli's theorem. From it one may, for instance, derive the familiar formula for the velocity of a liquid issuing from a hole in a tank, $u = \sqrt{2gh}$, where h is the head of fluid. In deriving this formula it is assumed that there is no work done from without, that friction can be neglected, that the pressure on top of the water in the tank is the same as the pressure outside the tank, and that the fluid is incompressible. These three assumptions cause the terms, W, ΣF, and $\int V\,dP$ to vanish.

For many purposes it is convenient to put Bernoulli's theorem in differential form, omitting the term of work done from without. To make this transformation we may assume that the distance from point 1 to point 2 becomes infinitesimal. Then $h_2 - h_1 = dh$, etc., so that Equation 6 becomes

$$-V\,dP = dh + \frac{u\,du}{g} + dF \quad (7)$$

At times it is also convenient to substitute the density s for its reciprocal V:

$$-\frac{dP}{s} = dh + \frac{u\,du}{g} + dF \quad (8)$$

From these fundamental expressions the common formulas for fluid transmission and measurement may be derived.

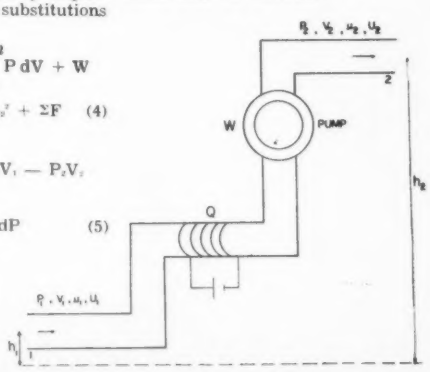

Fig. 1—Illustrating total energy balance.

*Associate professor, petroleum and natural gas engineering, Penn. State College.

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QUESTIONS ON TECHNOLOGY

by W. L. Nelson
Technical Editor

Viscosity at 122° F.—Blending, Etc.

In blending fuel oils we must constantly estimate the viscosity at 122° F. from data stated at 100° or 210° F. Is there a tabulation or simple method of doing this? S.P.A.

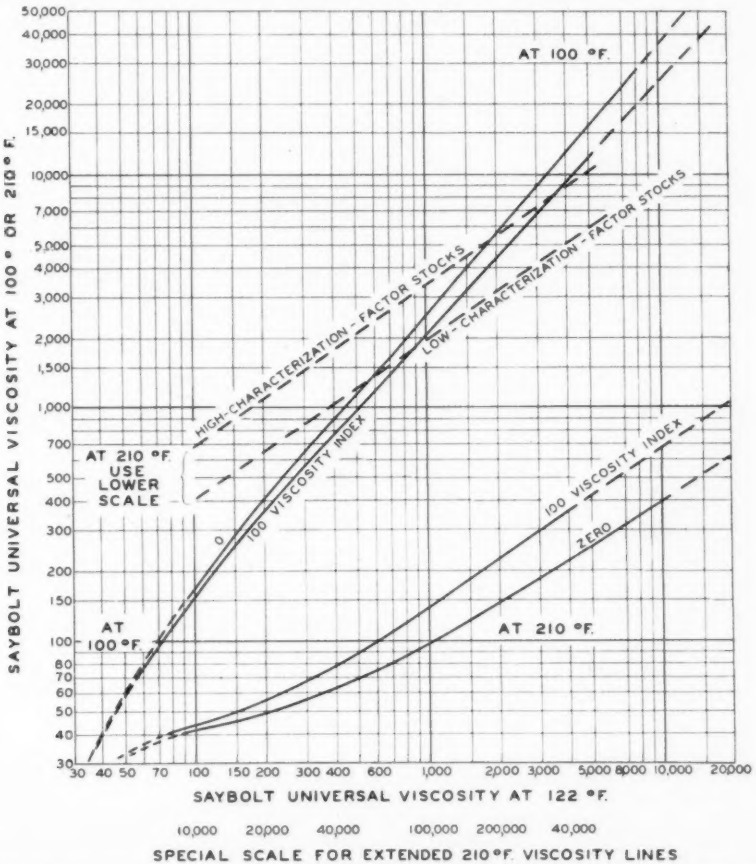
No such tabulation is known to this department but the need of such information is so obviously important that the chart shown on this page was prepared. It was prepared from A.S.T.M. viscosity index data and the viscosity at 122° F. was obtained by plotting on A.S.T.M. temperature relation graph paper. Extrapolations to the very high viscosities of asphalts or pitches are shown as dashed lines. The many lines should not lead to confusion; they are each read independently on the left and lower scales. The extrapolations represent most approximately, viscosity indexes of zero and 100.

Asphaltic stocks usually have characterization factors of about 11.3, and viscosity indexes of about zero. Cracked stocks have even lower factors and indexes.

Furol viscosity can be converted to Universal viscosity by multiplying by about 10.

Examples.—A zero viscosity index asphaltic material that has a viscosity of 700 at 210° F., (left scale) has a viscosity of about 23,000 at 122° F. (lowest of lower scales). Incidentally, the viscosity at 100° F. of such a stock would be almost 100,000 (off upper corner of chart).

A stock which has a viscosity of 60 at 100° F. (left scale) has a viscosity of 50 at 122° F. (main lower scale). Its viscosity at 210° F. will be 32 or 33 depending on its viscosity index.



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Improved Method for Mixing Chemicals

CHANGES in mixing chemicals have been made by the drilling department of Richfield Oil Corp. These changes represent considerable improvement over conventional practices. Packaged chemicals in powder form are stored in a weatherproof compartment and mixed in quantities with mechanical equipment when ready for use.

Part of the rig substructure has been converted into a room enclosed on sides and ceiling with tank steel. It is floored with mesh-type tread stock so that spills and waste water are rapidly drained off without damaging equipment and material, or creating a hazard for men working on the rig.

Underwriter-approved electrical equipment, permanently installed in this compartment, supplies lights, takeoffs for power, and switches for operation.

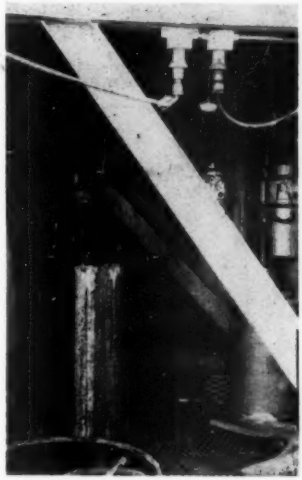
A cylindrical tank installed in one corner of the room is fitted with a "Lightnin" Model LD-50 chemical propeller-mixer so that the solution can be agitated until all of the dry material has been completely dissolved.

In a small alcove adjacent to the chemical-preparation compartment is a small motor-driven centrifugal pump which takes suction from the chemical tank. The discharge from the pump leads to a rectangular tank at the side of the rig, near the shale shakers. The tank piping is arranged so that necessary quantities of the chemical solutions can be introduced into the circulation at the outlet of the flow pipe.

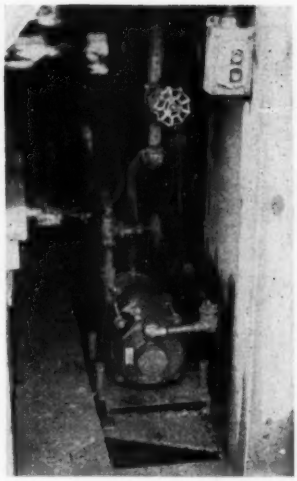
This method provides a weatherproof building, integral with the rig, for storing dry powder and mixing the solution with modern equipment. This replaces the older type which makes use of an oil drum with a manually operated paddle, all of which normally operates above the mud ditch below the shakers.

Mixing chemicals with the new equipment involves little labor. The time consumed is only that necessary to fill the mixing drum to the desired level with water, add the required amount of dry chemicals, and turn on a switch. The mixing continues until the current is shut off.

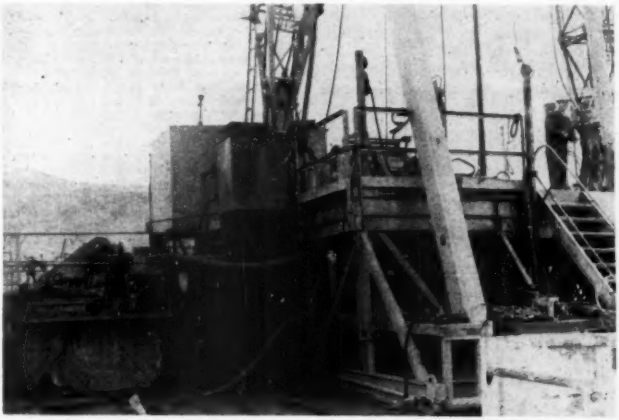
A solution is then available in which all of the chemical is dissolved. Immediate results are obtained down the hole as drilling progresses.



Tank and Lightnin' mixer used for mixing chemicals added to drilling mud.



Motor-driven pump used for transferring chemicals to storage tank on substructure.



Rectangular tank at the side of the derrick is used for storage of solutions of chemical mud additives.

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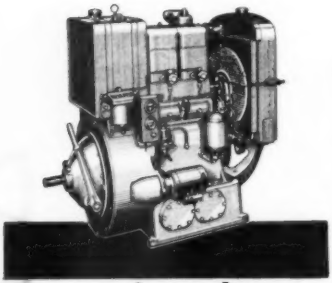

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Pipe-Line Construction

FOLLOWING is a tabulation of pipe-line projects which are planned or under construction. Included are crude-oil, products, and natural-gas lines. This list is compiled from surveys made by The Oil and Gas Journal.

Crude-Oil Pipe Lines

American Petroleum Co.—30 miles, 6-in., under way, Village Mills to Arriola Field, Hardin County, Texas. J. R. Stewart, contractor. Completion date 5-15-52.

8 miles, 12-in., authorized, looping Samaria to Earhart, Mich.

15 miles, 12-in., authorized, looping Sylvania, Ohio southward.

Cities Service Pipe Line Co.—64 miles, 18-in., planned, Sour Lake, Tex., to Lake Charles, La. Completion date 1-1-53.

19 miles, 8-in., under way, Cushing to Guthrie, Okla. Gragg Const. Co. Completion date 6-1-52.

Continental Pipe Line Co.—105 miles, 8-in., contracted, Rincon to northwest of Sullivan City on to Port Isabel, Tex. Western Const. Co. Completion date 9-30-52.

217 miles, 12-in., authorized, Wichita Falls, Tex., to Ponca City, Okla. Completion date 1952.

Gulf Refining Co.—80 miles, 24-in., proposed, Midland to Colorado City, Tex.

Humble Pipe Line Co.—4, 6, 8, 12-in., proposed, Upton and Reagan counties, Texas.

201 miles, 12-18-in., planned, Hawkins to Baytown, Tex.

Interstate Oil Pipe Line Co.—33 miles, 20-in., under way, Bunkie to Melville, La. Latex Const. of Georgia. Completion date 5-52.

68 miles, 16-in., authorized, Raceland to Anchorage, La. Completion date 10-52.

18 miles, 12-in., authorized, LaRose to Raceland, La. Completion date 10-52.

47 miles, 16-in., authorized, Sunset to Anchorage, La. Completion date 12-52.

21 miles, 12-in., planned, Duck Lake and Bayou Sale to New Iberia, La. 7-31-52.

36 miles, 16-in., planned, Flora to Bunkie La. Completion date 12-31-52.

42 miles, 4-6-10-in., planned, Esperance Pt., Fairview & Lisemore Landing, La., to Cranfield, Miss. Completion date 8-15-52.

Pan American Pipe Line Co.—27 miles, 26-in., planned, Genoa to Texas City, Tex. Completion date 12-52.

40 miles, 14-in., planned, Arden Station in Irion County to Eldorado Station in Schleicher County, Tex. 6-52.

Pasotex Pipe Line Co.—195 miles, 8-in., under way, El Paso to Wink, Tex.

Platte Pipe Line Co.—1,075 miles, 16, 20-in., under way, Worland, Wyo., to Wood River, Ill. Completion date 1952.

573 miles, 16-20-in., under way, Worland, Wyo., to Holdredge, Neb. R. H. Fulton & Co., contractor. A. A. Carrigan, spreadman at Scotts Bluff, Neb.

142 miles, 20-in., under way, Holdredge, Neb., to Kansas State Line, Fulton & Brodie, contractor, J. T. Brodie, spreadman.

Section 7, 274 miles, 20-in., Missouri River to Salisbury, Mo., and Section 8, Salisbury to Mississippi River, under way. O. R. Burden Construction Co. Al Perry, spreadman at Carrolton, Mo.; river crossing field office, Hartford, Ill., Dick Jernigan, spreadman.

Progress Pacific Pipe Line Co.—900 miles, 20-in., proposed, Permian basin, West Texas to California.

Rancho Pipe Line System.—455 miles, 24-in., authorized, McCamey to Houston, Tex. Completion date late 1952. (Joint project with Sinclair Pipe Line Co., Pan American Pipe Line Co., Tidewater Pipe Line Co., Nantucket Pipe Line Co., Phillips Pipe Line Co., and Ashland Pipe Line Co. with Shell Pipe Line Corp. handling construction and operation.

267 miles, contracted, McCamey to Cedar Valley near Austin, Tex. Anderson Bros. Corp.

190 miles, 24-in., contracted, Austin to Shell's Deer Park Refinery (Houston area).

Roosevelt Oil & Refining Corp.—22 miles, 4 and 6-in., authorized, St. Helens to Norwich, Mich.

Service Pipe Line Co.—29 miles, 10-in., planned, Saunders to Denton, N. M. Completion date 5-52.

33 miles, 16-in., planned, Bowie, Tex., to Drumright, Okla.

30 miles, 6-in., Knox and Haskell counties, Texas.

29 miles, 4, 6, 8-in., proposed, Natrona County, Wyoming.

Shell Pipe Line Corp.—42 miles, 8-in., authorized, Hallettsville to La Grange, Tex. Completion date 7-1-52.

66 miles, 8-in., authorized, Gohlke to La Grange, Tex. Company crews. Completion date 1952.

Sinclair Pipe Line Co.—674 miles, 22, 24-in., under way, Drumright, Okla., to East Chicago, Ind. Completion date 1952.

Section 1—150 miles, 24-in., under way, Drumright-Cushing, Okla., area, to Humboldt, Kans. O. R. Burden Construction Co.

(Spread 1) 60 miles, 24-in., under way, Caney to Humboldt, Kans. A. B. Haynes, supt., at Chanute, Kans.

(Spread 2) 90 miles, 24-in., under way, Cushing, Okla., to Caney, Kans. Floyd Lewis spreadman at Hominy, Okla.

184 miles, 24-in., under way, Humboldt, Kans., to Salisbury, Missouri. R. H. Fulton & Co., contractor, M. L. Boyd and Jerry Nash, spreadmen.

Sterling Pipe Line System.—53 miles, 12-in., authorized, Sterling, Colo., to connection with Platte Pipe Line at Gurley, Neb. (includes 20 miles, 10-in., main line; 35 miles, 8-in., branch lines.) Joint venture comprising Toronto Pipe Line Co., Shell Pipe Line Corp., and Texas Pipe Line Co.

Sun Pipe Line Co.—99 miles, 4, 6, 8-in., proposed, Scurry County, Tex.

34 miles, 8-in., planned, Jameson to Colorado City, Tex.

13 miles, planned, Cogdell to Brice Island.

Texas Pipe Line Co.—319 miles, 22, 12, 10-in., under way, Louisiana Gulf Coast to Port Arthur, Tex., including 220 miles, 22-in., Houma, La., to Port Arthur, Tex.; 31 miles, 12¾-in., Houma to Cocodrie, La. Houston Contracting Corp. Completion date in summer 1952.

175 miles, 16-in., under way, Corsicana to East Houston. Smith Contracting Corp. Frank Craig, spreadman at Teague, Tex. Completion early summer.

319 miles, 22, 12, 10-in., under way, Louisiana Gulf Coast to Port Arthur, Tex. Houston Contracting Co.

220 miles, 22-in., under way, Houma, La., to Port Arthur, Tex. Houston Contracting Co.

67 miles, 22-in., under way, Holmwood, La., west to Port Arthur, Tex. Houston Contracting Co., E. C. Norris, superintendent at Lake Charles, La.

67 miles, 22-in., under way, Holmwood east to Gueydan, La., and from Morgan City east to Houma. Houston Contracting. W. H. Hayes, superintendent, at Jennings, La.

86 miles, 22-in., under way, Gueydan east to Morgan City, La. Houston Contracting. F. A. Silar, superintendent, at Abbeville, La.

65 miles, 6, 8, 10-in., under way, and 30 miles, 12-in., Houma, La., south through Terrebonne Bay vicinity. Houston Contracting. H. L. Leake, superintendent, at Houma.

West Coast Pipeline Co.—986 miles, 20-22-in., planned, Snyder, Tex., to Norwalk, Calif.

West Texas Gulf Pipe Line Co.—471 miles, 26-in., contracted, Colorado City to Wortham, Tex., Wortham to Sour Lake, Tex., 34-in. Completion date 10-52.

114 miles, 20-in., contracted, Wortham to Longview, Tex. Completion date 10-52.

44 miles, 26-in., under way, Glenrose, Tex. area. Anderson Brothers, contractor.

120 miles, 26-in., contracted, East of Abilene, Tex. Associated Pipe Line Contractors, Inc.

60 miles, 26-in., contracted, Colorado City to Abilene, Tex. Anderson Bros. Corp.

94 miles, 26-in., contracted, West of Wortham, Tex. Anderson Bros.

Products Pipe Lines

Bell Oil & Gas Co.—150 miles, 6-in., planned, Ardmore to Drumright, Okla. (Includes 114 miles, 8-in., 32 miles, 6-in.)

Buckeye Pipe Line Co.—370 miles, 8, 12, 16-in., authorized, Linden, N. J., via Allentown, Pa., to Auburn, Syracuse, Waterloo, and Rochester, N. Y. (Sections divided as follows: 75 miles, 16-in., 218 miles, 12-in., 77 miles, 8-in.). Completion of 16-in., 1952, balance 1953.

Coastal Products Pipe Line Co.—260 miles, 20-in., proposed, Houston to Baton Rouge

Derby Oil Co.—30 miles, 4-in., under way, Wichita to Bell, Kans. Completion date 7-1-52.

Keystone Pipe Line Co.—60 miles, 12-in., proposed, Pt. Breeze, Pa., to Montello, Pa. Completion date 12-31-52.

Ohio Oil Co.—255 miles, 8, 10-in., proposed, East St. Louis, Ill., to Indianapolis.

24 miles, 8-in., authorized, East St. Louis to Wood River, Ill.

214 miles, 12-18-in., planned, Lima to East Sparta and Newark, Ohio.

Phillips Oil Co.—28 miles, 12-in., authorized, Sweeny to Freeport, Tex. Completion date 3-52.

Phillips Pipe Line Co.—42 miles, 10-in., under way, Green Ridge to Villa Ridge, Mo. Mid-States Const. Co. T. H. Edmonds, superintendent at Sedalia, Mo.

68 miles, 12¾-in., under way. Osawatomie westward to Wichita, Kans. Brown Lite Co. R. E. Carriker, spreadman at Osawatomie, Kans.

40 miles, 10-in., through Monteau, Cole, Osage, and Gasconade counties, Missouri, Trojan Const. Co. E. L. Maggard, spreadman at Linn, Mo.

Under way, Paloa, Kans.-Harrisonville, Mo. Smith Contracting Corp.

74 miles, 8-in., under way, looping from Decatur, Ill., to East Chicago, Ind. Somerville Const. Co., contractor.

137 miles, 10-in., authorized, looping from Paola, Kans., to East St. Louis, Ill.

Pioneer Pipe Line Co.—(Continental Pipe Line Co. and Sinclair Pipe Line Co.). 310 miles, 8-in., proposed, Sinclair, Wyo., to Salt Lake City, Utah.

Progress Pacific Pipe Line Co.—900 miles, 10-in., proposed, California to West Texas

Salt Lake Pipe Line Co.—Proposed, Pasco, Wash., to Puget Sound.

330 miles, 8-in., planned, Salt Lake City, Utah to Boise, Idaho. Completion date 12-1-52.

Shell Oil Co.—565 miles, 8-14-in., planned. Wood River via East Chicago to Detroit; 35 miles, 14-in. Completion date summer of 1952.

Sinclair Pipe Line Co.—10-in., Houston to Baton Rouge; 16-in., Kalamazoo to Detroit; 20-in., Marcus Hook to Bayonne, N. J.; East Chicago to South Bend, Ind.

8-10-in., planned, Sinco to Port Arthur, Tex.

Standard Oil Co. (Ind.).—316 miles, 12-in., proposed, Sugar Creek refinery to Dubuque, Iowa.

122 miles, 8-in., under way, Neodesha, Kans., to Belton, Mo. Bills & Troth Construction Co., Carl Bills, superintendent, at Armory Building, Neodesha. Completion date 1952.

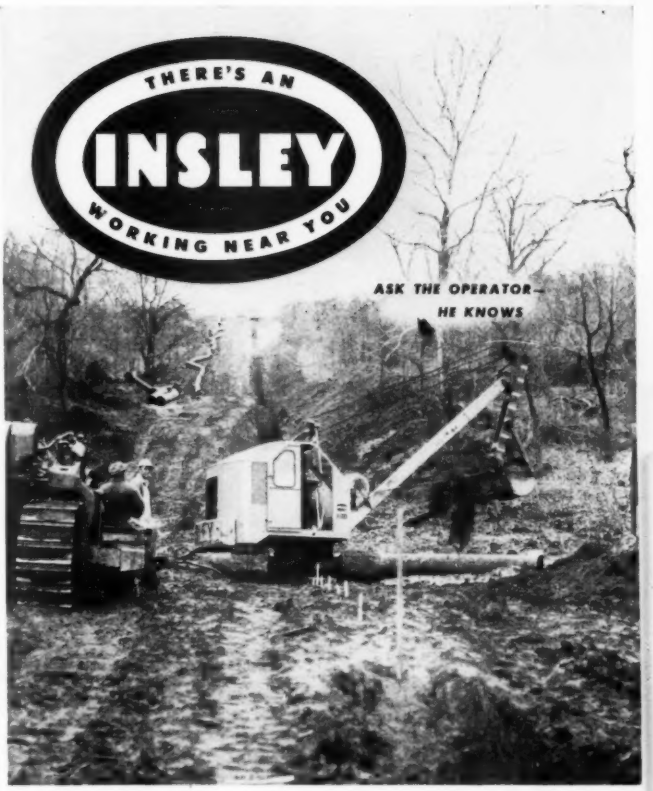
Standard Oil Co. (Ohio).—17 miles, 6-in., authorized, Toledo to West Toledo, Ohio.

Sun Pipe Line Co.—110 miles, 8-in., under way, Fostoria to Hudson, Ohio.

Susquehanna Pipe Line Co.—123 miles, 6, 8-in., proposed, Fostoria to Randolph, Ohio.

Tuscarora Oil Co.—74 miles, 6-10-12-in., under way, Allentown to Midland, Pa.

United States Pipe Line Co.—1,000 miles, proposed, Gulf Coast via Memphis, Nashville, Tenn., Lexington, and Paducah, Ky., to Cincinnati, Ohio.



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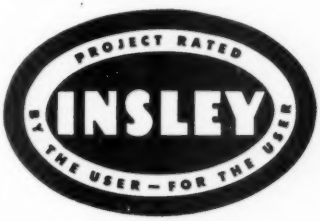

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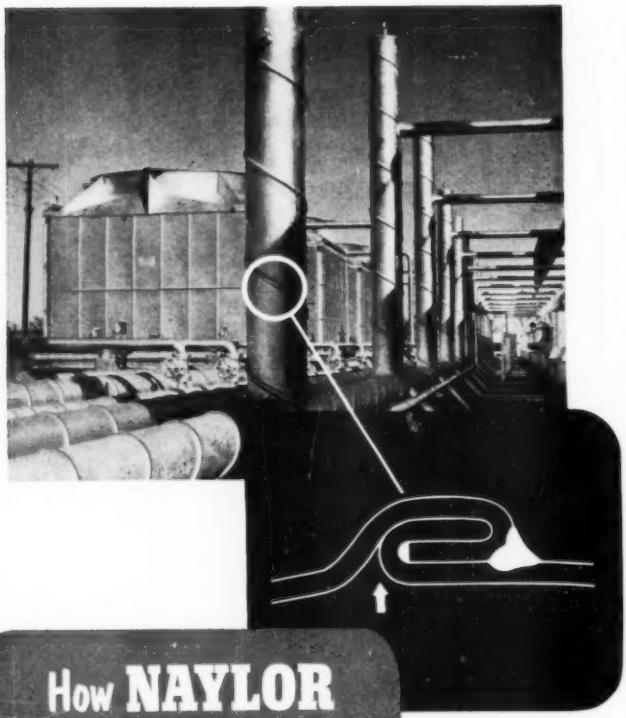

How NAYLOR gives you EXTRA SAFETY in Light-weight Pipe

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Natural-Gas Pipe Lines

Algonquin Gas Transmission Co.—140 miles, 24-26-in., under way, New Jersey to Connecticut River near New Haven. Williams Brothers, contractor. Robert L. Buck, project manager, Danbury, Conn. Spreadmen: Thelmer Davis, Waterbury, Conn., O. L. Martin, Sloatsburg, N. Y., O. R. Mitchell, Danville, N. J. Completion date 8-1-52.

Allied Gas Co.—24 miles, 6⅝-in., proposed, McLean to Champaign County, Illinois.

Arkansas-Missouri Power Co.—140 miles, 2-10-in. planned, Arkansas and Missouri.

Associated Natural Gas Co.—88 miles, authorized, Missouri.

Carolina Natural Gas Corp.—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

Cities Service Gas Co.—179 miles, 4-30-in., gathering system in vicinity of Ulysses, Kans. Vaughn & Taylor Const. Co., Inc D. D. Vaughn, spreadman, Ulysses.

21 miles, 26-in., proposed, Franklin and Anderson counties, Kansas.

15 miles, 20-in., Craig County, Oklahoma, to Lawrence County, Missouri.

Coast Counties Gas & Electric Co.—40 miles, 3, 4, and 8-in., planned. Coast and Valley region, California.

Colorado Interstate Gas Co.—280 miles, 20-in., under way, Kit Carson, Colo., to Amarillo, Tex. R. H. Fulton & Co., contractor. Jerry Nash, spreadman at Lamar, Colo.

16 miles, 4-in., Pueblo County to Fowler, Colo.

Commonwealth Natural Gas Corp.—537 miles, 20-in., proposed. West Bend, Ky., to Norfolk, Va.

Cumberland & Allegheny Gas Co.—46 miles, 10-in., authorized, Mountain Lake Park, Md., to Preston County, West Virginia.

Dow Chemical Co.—70 miles, various sizes. Midland, Saginaw, and Bay City, Mich. Mahoney Contracting Co., contractor. Ralph Bucher, spreadman at Midland.

East Tennessee Natural Gas Co.—172 miles, 22-in., authorized, Greenbrier to Oak Ridge, Tenn.

100 miles, 16-in., proposed, Knoxville to Kingsport, Tenn.

El Paso Natural Gas Co.—133 miles, 30-in., proposed, looping along main line in Texas, New Mexico, Arizona.

36 miles, 24-in., proposed, looping from Kingman to Franconia, Ariz.

Equitable Gas Co.—17 miles, 16-in., under way, near Pittsburgh, H. L. Gentry Const Co., contractor. Lavern Curtis, spreadman at Sewickley, Pa.

Georgia Gas Co.—32 miles, 4½-in., proposed, Bogart to Gainesville, Ga.

Glacier Gas Co.—285 miles, 20-in., proposed, Kalispell, Mont., to Spokane, Wash.

120 miles, 16-in., proposed, Spokane to Hanford, Wash.

91 miles, 8⅝-in., proposed, Spokane to Lewiston, Idaho.

130 miles, 12¾-in., proposed, Spokane to International boundary at Trail, British Columbia.

Grand Valley Pipe Line Co.—105 miles, 8-10-in., planned, Piceance Creek field to Rifle on to Grand Junction, Colo.

Gulf Interstate Gas Co.—1,000 miles, 30-in., planned, Gulf Coast to North Kentucky.

Home Gas Co.—32 miles, proposed, Chemung and Broome counties, New York.

17 miles, 12-in., proposed, loops from Hancock to Sanford, N. Y.

Iowa-Illinois Gas & Electric Co.—41 miles 10-in., authorized, Washington County to Cedar Rapids, Iowa.

¾ to 6-in., under way, Davenport, Iowa, and Moline, Ill. C. E. Wilson Const. Co.

Kansas-Nebraska Natural Gas Co., Inc.—179 miles, proposed, Kansas and Nebraska.

20 miles, 16-12-in., planned, Hastings to Grand Island, Neb. Completed date 1952.

18 miles, 6-8-in., planned, McCook Neb., south. Completion date 1952.

54 miles, 4-6-in., planned, Neligh to Hartington, Neb. Completion date 1953.

49 miles, 10-in., planned, Ogallala to North Platte, Neb. Completion date 1952.

20 miles, 12-in., planned, Atwood to near Oakley, Kans. Completion date 1952.

Kansas Power & Light Co.—27 miles, 20-in., authorized. Pratt, Kans., to Calista compressor station.

28 miles, 12-16-in., planned, north of Kansas to Meade County Gas Field.

Lake Shore Pipe Line Co.—45 miles, 10¾-in., authorized, northwesterly from T.G.T. system near Meadville, Pa., to Ashtabula, Ohio.

Lone Star Gas Co.—100 miles, proposed, storage fields to the Dallas-Fort Worth area. 35 miles, 12-in., proposed, southeastern Schleicher County.

Manufacturers Gas Light & Heat Co.—40 miles, proposed, Allegheny, Washington, and Beaver counties, Pennsylvania.

Michigan Gas Storage Co.—93 miles, 16, 22, 24-in., under way, Laingsburg to near Pontiac and Mount Clemens, Mich. (Includes 17 miles of lateral lines.) Mahoney Contractor. Completion date 6-52.

30 miles, 26-in., authorized, looping between Laingsburg and Mount Pleasant Junction, Mich.

Michigan Gas Utilities Co.—77 miles, under way, Sturgis, Hillsdale, and Coldwater, Mich. (22.7 miles, Marshall south to Coldwater; 20 miles, Coldwater easterly to Hillsdale; 22.5 miles, Hillsdale to Sturgis, 11 miles, Hillsdale to Jonesville.) Somerville Const., contractor, Jim Godwin at Coldwater.

MidSouth Gas Co.—240 miles, proposed, Greene, Poinsett, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, and Cross counties, Arkansas.

Minneapolis Light & Power Co.—20 miles, 30-in., under way, Minneapolis, Williams Bros., contractor. F. W. Caldwell, spreadman.

Mississippi River Fuel Corp.—98 miles, 16- and 18-in., authorized, feeder line from Lincoln Parish, Louisiana, to Waskom field, Harrison County, Texas.

40 miles, 18-in., authorized, Dubach to Perryville, La.

Missouri Central Gas Co.—25 miles, 6-in., contracted, Moberly to Macon, Mo. L. R. Young Const. Co.

Montana Power Co.—52 miles, 16-in., authorized, Canada-Montana border to Cut Bank, Mont.

National Utilities Co. of Michigan.—76.7 miles, 20-in., proposed, South Central Michigan. (22 miles from near Marshall south to Coldwater; 20 miles east to Hillsdale; 22 miles southwest to Sturgis; 5 miles from Hillsdale to Jonesville and 8 miles west to Union City.)

Nevada Natural Gas Pipe Line Co.—114 miles, 10-in., proposed, Topock, Ariz., to Las Vegas, Nev.

New River Gas Co.—50 miles, planned, Summers to Monroe counties, West Virginia to Narrows and Dublin, W. Va.

New York State Natural Gas Corp.—104 miles, 14, 16, 20-in., authorized, looping on Westmoreland, Armstrong, and Tioga counties, Pennsylvania. (Includes 17 miles, 16-in., in Potter County, Pennsylvania, and 21 miles 14-in., replacement in Line No. 507, New York.)

12 miles, 20-in., under way, looping at Zelienople, Penn. Williams-Austin Co. Ralph Gaddy, supt. 5-15-52.

52 miles, 16-in., contracted, Utica to Amsterdam, N. Y. (to begin at completion of Zelienople). Williams Austin. Ralph Gaddy, supt. Completion in 90 days.

20 miles, 20-in., begin 5-1, Cayuta Gate to Ithaca, N. Y. Williams-Austin Co. Howard Bauer, supt. Completion date 6-30-52.

30 miles, 20-in., contracted, Angelica to Rossburg, N. Y. (begin at completion of Cayuta-Ithaca). Williams-Austin. Howard Bauer, supt. Completion in 45 days.

17 miles, 16-in., contracted, Colesburg Junction to Sabinsville, Pa. (begin at completion of Angelica job). Williams-Austin. Howard Bauer, supt.

21 miles, Columbiana and Stark counties, Ohio.

Niagara Mohawk Power Corp.—55 miles, 10-in., Fulton to Watertown, N. Y.; Williams-Austin Co., contractor, Howard Bauer, supt. Completion date 9-52.

Northeastern Gas Transmission Co.—221 miles, 20-24-in., authorized, New Hampshire, Massachusetts, and Connecticut.

Northeastern Gas Co.—411 miles, proposed, New England towns.

Northern Natural Gas Co.—580 miles, proposed, Kansas, Texas, Oklahoma, and Nebraska loops.

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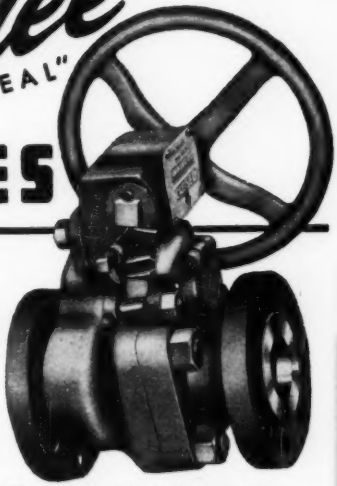

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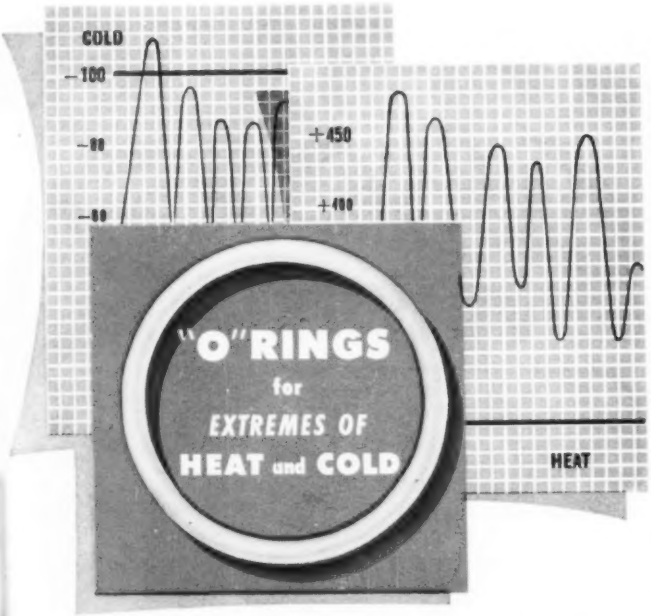

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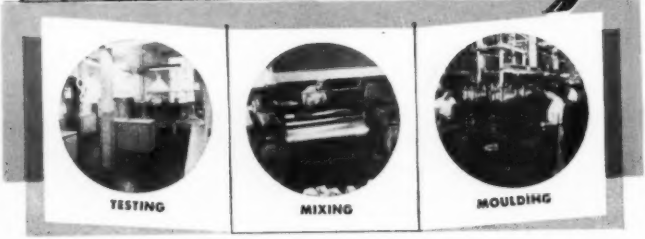


210 miles, 26-in., proposed, five loops in Texas-Oklahoma area, two in Kansas, and two in Nebraska.

400 miles, 24-in., proposed, Emerson, Manitoba south to Red River Valley through Fergus Falls on to St. Paul, Minn.

Northern Indiana Fuel & Light Co.—33 miles, 8-in., proposed, Edgerton to Auburn, Ind.

Northwest Natural Gas Co.—750 miles, planned, Washington, Oregon, and Idaho.

373 miles, 24-in., proposed, Eastport, Idaho, to Monroe, Wash.

79 miles, 18-in., proposed, Monroe to International boundary near Lynden, Wash.

29 miles, 22-in., proposed, Monroe to near Seattle, Wash.

164 miles, 20-in., proposed, Seattle to Portland, Ore.

Ohio Fuel Gas Co.—31 miles, 20-in. authorized, Licking County to Richland County, Ohio.

22 miles, 16-in., authorized, Dayton, Troy, Piqua, and Sidney, Ohio.

23 miles, 16-20-in., authorized, Wellington to Elyria, Ohio; 16 miles, 20-in., authorized, Benton Station to Crawford Station. 18 miles, 20-in., Crawford Station to near Columbus. 16 miles, 16-in., authorized, Berlin to Sandusky, Ohio.

74 miles, 3 to 20-in., authorized, Hocking, Knox, and Ashland counties, Ohio.

47 miles, 20-in., authorized, Benton Township, Hocking County, to Columbus, Ohio.

61 miles, authorized, northern and southwestern Ohio.

33 miles, 20-in., proposed, Jefferson to Seneca, Ohio.

Pacific Gas & Electric Co.—44 miles, 8-in under way, Salinas to King City, Calif. Completion date 1952.

141 miles, 34-in., proposed, parallel sections along Topock-Milpitas line.

10 miles, 10-12-in., authorized, Monterey to Fort Ord to Castroville; 12 miles, 16-in., Napa Wye to Shellville; 6 miles, 12-in., Cotati to Santa Rosa, Calif.

Pacific Northwest Pipeline Corp.—26-in. Alberta fields through to Pincher Creek, Spokane, Hanford, Vancouver, and Portland.

Panhandle Eastern Pipe Line Co.—70 miles, 24-26-in., under way, looping from Sneed, Tex., to Emporia, Kans.

174 miles, 30 and 26-in., contracted. Tuscola, Ill., eastward—looping present system; R. A. Conyes, contractor.

44 miles, 26-in., Edgerton, Mich., Anderson Bros.

22 miles, 30-in., looping in Tuscola, Ill.

45 miles, 30-in., looping in Montezuma, Ind.

63 miles, 30-in., looping in Zionsville, Ind.

Pennsylvanian Gas Co.—52 miles, 12-in., between Warren and Erie, Pa. Section 1—27 miles, under way and contracted by Harford Bros. Section 2—25 miles.

Peoples Natural Gas Co.—25 miles, proposed, Cambria and Blair counties, Pennsylvania.

Permian Basin Pipeline Co.—384 miles, 20-30-in., proposed. Permian Basin area to eastern New Mexico.

139 miles, planned, Upton County, Texas, to Lea County, New Mexico.

76 miles, planned, Lea County to Roosevelt County, New Mexico.

169 miles, planned, Roosevelt County, New Mexico, to Carson County, Texas.

Phillips Petroleum Co.—118 miles, 3-22-in., under way, Sherman and Hansford counties, Texas, gas-gathering system; Vaughn & Taylor Construction Co., Inc., Dumas, Tex., J. F. Crawford, spreadman at Texhoma, Okla.

Prince George's Gas Corp.—20 miles, 22-in., authorized, between Chillum and Rockville, Md.

Public Service Co. of Colorado.—95 miles, proposed, Douglas Creek and other gas fields to Grand Junction, Colo., area.

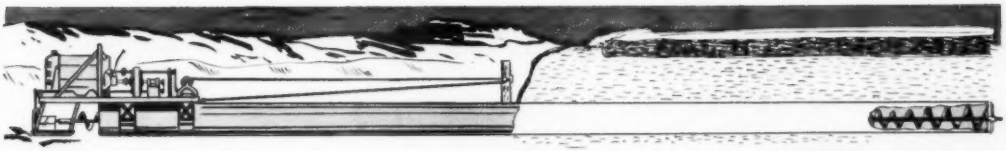
Public Service Co. of North Carolina.—33 miles, 10-in., authorized, Burlington to Chapel Hill, N. C.

16 miles, 8-in., authorized, Chapel Hill to Raleigh, N. C., completion date 7-1-52.

29 miles, 4-in., authorized, Statesville to Kanapolis, N. C., completion date 7-1-52.

83 miles, 8-in., authorized, Kings Mountain to Asheville, N. C., completion date 3-1-53.

Rockland Light & Power Co.—22 miles,



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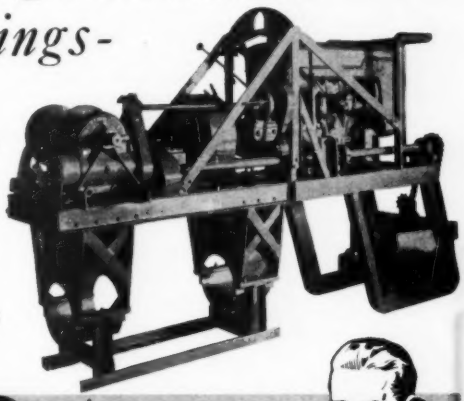

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8-in., proposed, Orangetown to Tompkins Cove, N. Y.

South Georgia Natural Gas Co.—339 miles, 2-12-in., proposed, Florida and Georgia.

Southern California Gas Co.—35 miles, planned, Antelope Valley, California.

Southern California Gas Co. and Southern Counties Gas Co. of California.—45 miles, 30 in., proposed, looping on line from Arizona border to Los Angeles.

81 miles, 30-in., proposed, Whitewater to Desert Center, Calif.

Southern Natural Gas Co.—21 miles, 24-in., authorized, Perryville Station La., to Boeuf River.

14 miles, 24-in., authorized, Onward Station, Miss., to Big Sunflower River.

14 miles, 14-in., authorized, Perryville Station, La., to Wilhite Gate.

375 miles, 24-in., planned, Gwinville, Miss., to Atlanta, Ga.

169 miles, proposed loops, Ouachita Parish, Louisiana, to Augusta, Ga.; 20 miles in Ouachita Parish, 33 miles in Ouachita and West Carroll parishes; 7 miles, Sharkey County, Mississippi; and 108 miles, 14-in., Bass Junction to Augusta, Ga.

Southern Union Gas Co.—21 miles, 20-in., authorized, Albuquerque, N. M.

27 miles, 10-in., authorized, Lea and Eddy counties, New Mexico.

30 miles, 12-20-in., contracted, San Juan County, New Mexico. R. H. Fulton & Co.

Southwest Gas Corp., Ltd.—26 miles, proposed, from P.G.&E. line to Victorville, Calif.

Tennessee Gas Transmission Co.—591 miles, 24-30-in., proposed, looping along present system (consisting of 323 miles of 30-in.; 167 miles of 26-in.; 101 miles of 24-in.)

420 miles, 30-in., Texas, Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky.

101 miles, 26-in., Kentucky and Ohio.

304 miles, 24-in., proposed, Mercer, Pa. to Utica, N. Y.

250 miles, miscellaneous laterals.

Texas Eastern Transmission Corp.—791 miles, 30-in., under way, Kosciusko, Miss., to Connellsville, Pa.

Section 8, 77 miles, 30-in., under way Portsmouth to Amesville, Ohio. Anderson Bros. Corp.

Section 9, 74 miles, 30-in., under way Amesville to Ohio-West Virginia river crossing. Anderson Bros. Corp.

Section 10, 66 miles, 30-in., under way Ohio River to Connellsville, Pa. Anderson Bros Corp.

Texas Gas Transmission Corp.—406 miles 26-in., proposed, looping from Bastrop to Hardinsburg, Ky.

223 miles, 26-in., proposed, Bastrop, La. to Covington, Tenn.

47 miles, 26-in., proposed, northeastward from Covington.

49 miles, 26-in., proposed, northeastward from Kenton, Tenn.

45 miles, 26-in., proposed, northeastward from Calvert City, Ky.

25 miles, 26-in. proposed, northeastward from Slaughters, Ky.

19 miles, 26-in., proposed, southwestward from Jeffersontown, Ky.

180 miles, 26-in., authorized, Acadia Parish to connection with existing facilities in Morehouse Parish.

35 miles, 12-in., authorized, Slaughters Ky., to Evansville, Ind.

195 miles, 26-in., proposed, Gulf Coast region to southwestern Louisiana.

560 miles, 26-in., proposed, Louisiana and Kentucky.

Texas-Ohio Gas Co.—1,350 miles, 30-in., proposed, Hidalgo County, Texas, through Arkansas, Mississippi, Tennessee, and Kentucky on to Spencer, W. Va. Completion date 6-30-53.

Union Oil Co. of California.—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles basin.

United Fuel Gas Co.—33 miles, 30-in., under way, Lanham to Broad Run, W. Va. H. L. Gentry Construction Co., contractor Frank Morris, spreadman at Charleston W. Va.

United Gas Pipe Line Corp.—315 miles 24-30-in., under way, Agua Dulce to near Goodrich, Tex. Oklahoma Contracting Co. contractor. Panama Shiflett, spreadman, El Campo, Tex.; Ray Law, spreadman, Victoria Tex.

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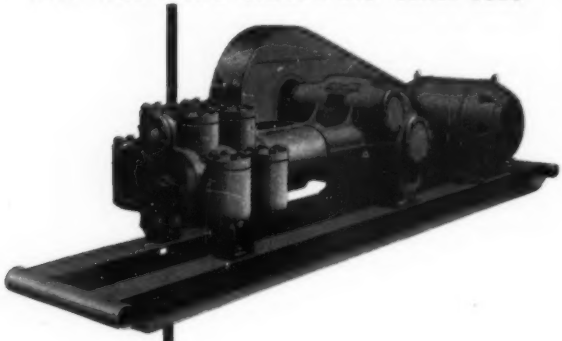

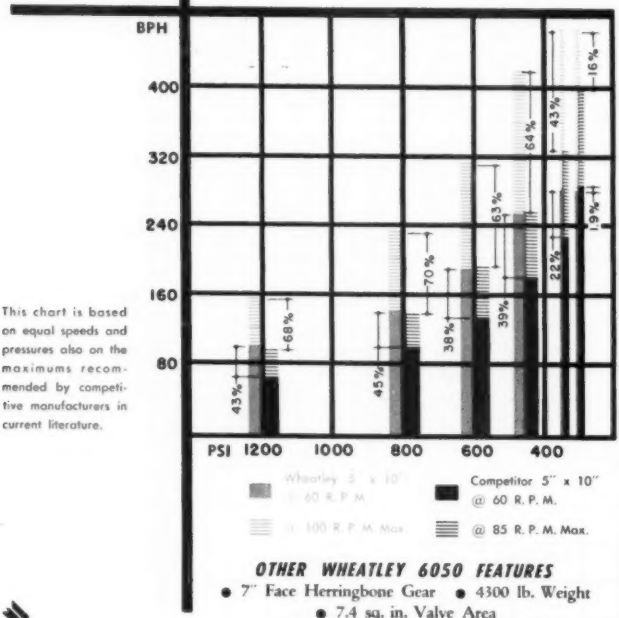

This chart is based on equal speeds and pressures also on the maximums recommended by competitive manufacturers in current literature.

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510 miles, 20 to 30-in., under way, Agua Dulce, Tex., to Monroe, La. River Const. Corp., contractor.

Spread 1, 51 miles, 30-in., from Pearl River north and south of Jackson, Miss. Red Tatom, superintendent at Jackson.

Spread 2, 45 miles, 30-in., McComb to Pearl River south of Jackson. Merle Tatom, superintendent at Hazelhurst.

Spread 3, 30 miles, 30-in., Kosciusko south toward Jackson. Jimmy Reed, superintendent at Kosciusko.

Spread 4, 29 miles, 12-in., Lafayette to Jeanerette, La. Roy Earnhart, spreadman at Jeanerette.

124 miles, Sterlington compressor station, near Monroe to Jackson, Miss.

23 miles, 8-12-16-in., South Louisiana facilities.

53 miles, 24-in., authorized, Texas.

36 miles, proposed, offshore from Ingleside to near Refugio, Tex.

All contracted by River Const. Corp., a joint venture including Oklahoma Contracting Co.; J. Ray McDermott & Co., Inc., and Morrison-Knudson. Inspection by Brown & Root, Inc.

Virginia Natural Gas Co.—153 miles, Buckingham to Richmond and Portsmouth, Va.

Western Kentucky Gas Co.—2 to 4-in., under way, additions to present system; Modern Welding Co., Inc., contractor.

Western Pipe Lines.—1,200 miles, 22-in., planned, southern Alberta to Duluth, Minn.

West Texas Gas Co.—27 miles, 10-in., authorized, Lubbock to Abernathy, Tex.

Wilcox Trend Pipe Line Co. (Harry Bass Drlg. Co.)—150 miles, various up to 20-in., planned, gathering system for delivery to proposed Texas Eastern terminal at Provident City, Tex.

Foreign Crude-Oil Pipe Lines—Planned and Under Way

Alberta-Vancouver Oil Pipe Line Co.—(Brokaw, Dixon, McKee).—972 miles, 16-in., proposed, Edmonton via Pincher Creek, Alta., Idaho and Washington states to Vancouver, B. C.

Cia. de Petroleo Ganso Azul, Ltd.—48 miles, 4-in., planned, Ganso Azul field to Pucalpa on upper Ucayali River, Peru.

Condor.—90 miles, 12-in., under way, Genoa to Rho, near Milan, Italy. Soc. Ital Condotte Acqua Montubi, contractor. Completion date 7-31-52.

Creole Petroleum Corp.—143 miles, 26-in., under way, Ule (State of Zulia) to Amuay (State of Falcon). Williams Bros. de Venezuela, S. A., contractor of overland sections. Charles Williams, manager; Marvin Jones, general superintendent, Maracaibo. McWilliams, Gahagan, and Anderson Bros., contractors of water crossings. Completion date March 1953.

25 miles, 34-in., authorized, Lagunillas to La Salina (State of Zulia). Completion date April 1953.

Direccion General de Yacimientos Petroliferos Fiscales.—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Interprovincial Pipe Line Co.—100 miles, 16-in., contracted, Regina, Sask., to Gretna, Man., Canada. Anderson International Contractors, Ltd.

Iraq Government.—135 miles, 12-in., proposed, from Iraq Petroleum Co. at Baija to Baghdad, Iraq. Construction 1952, M. W Kellogg, contractor.

72 miles, 12¾-in., Zubair to Fao. Arabian Bechtel Co., contractor.

Kuwait Oil Co., Ltd.—10 miles, 20-in., authorized, third transit line Burgan-Ahmadi. Completion date 2-52. 6 miles, 30-in., authorized, sixth gravity loading line, Ahmadi-Mina al Ahmadi. Completion date 6-52. 5 miles, 16-20-in., authorized, Burgan field—oil collecting line. 2-52.

Middle East Pipelines, Ltd.—800 miles, 34-35-in., planned, Iran to a Levantine port.

Petroleos Mexicanos.—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

100 miles, planned, Isthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

Spitz & O'Berine.—264 miles, 24-in., under way, Capetown to Tarrytown, South Africa. J. C. Spitzexplari, spreadman at Capetown.

Texas Petroleum Co.—60 miles, 4-6-in., under way, Pto. Nino to La Dorada.

Trans-Mountain Oil Pipe Line Co.—639 miles, 24-in., proposed, Edmonton, Alta., to Vancouver, B. C. Canadian Bechtel, Ltd., engineers.

221 miles, 24-in., contracted, center section of line, Mannix, Ltd.

472 miles, 24-in., contracted, Western section of line, Comstock Midwestern, Ltd. Const., contractor. Jim Godwin at Coldwater.

Foreign Products Pipe Lines—Planned and Under Way

Colombia Ministry of Petroleum.—90 miles, 6-in., planned, Puerto Berrio to La Dorada, Colombia.

113 miles, 6-in., contracted, Puerto Berrio to Acededo near Medeillin, Colombia. Carolina Construction Co.

75 miles, 4-in., planned, Buena Ventura to Cali, Colombia.

Empresa de Ferrocarriles Ecuatorianos.—50 miles, 6-in., contracted, Guayaquil to Palmira, Ecuador. J. A. Jones, contractor; C.R.C. Engineering Co., engineers.

Estrada de Ferro Santos a Jundiai.—32 miles, 18-in., under way, Santos to Sao Paulo, Brazil ((fuel oil line); Techint, contractor. Completion date 12-51.

Governments of Southern Rhodesia and Portuguese East Africa.—200 miles, considered, Beria, Portuguese Mozambique to Umtali, Southern Rhodesia.

Imperial Oil Co., Ltd.—170 miles, 10-12-in., under way, Hamilton to Toronto, Ont., Canada, Comstock-Midwestern, Ltd., contractor. Completion date July 1952.

Petrocongo (Sub. Cie. Financiere Belge des Petroles, S.A.).—225 miles, considered, Ango-Ango to Leopoldville, Belgian Congo.

Societe des Transports Petroliers par Pipe Line.—140 miles, 10-in., under way, Le Havre to Paris, Fance. Entrepose, contractor. Completion date 1952.

State of Cundinamarca, Colombia.—120 miles, 6-in., Puerto Salgar to Bogota, Colombia; Williams Brothers Co.; David Louthen, manager, Bogota.

Trans-Northern Pipe Line Co.—440 miles, under way, Hamilton, Ont., to Toronto, Ont., to Montreal, Que., Canada.

Foreign Natural-Gas Pipe Lines—Planned and Under Way

Azienda Generale Italiana Petroli.—110 miles, 12-14-16-in., planned, Cortemaggiore to Genoa.

145 miles, 14-16-in., under way, Cortemaggorie to Torino. Completion date 1951.

Canadian Delhi Oil Co. (Subsidiary Delhi Oil Co.).—2,132 miles, proposed, Alberta, Toronto, Montreal.

Direccion General del Gas del Estado.—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

Northwest Natural Gas Co.—950 miles, 24-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

Petroleos Mexicanos.—205 miles, 16-in., considered, Monterrey to Torreon, Mexico.

260 miles, 20-in., under way, Monterrey to Tampico and Poza Rica, Mexico.

Petroleos Mexicanos, Mexican Gas Co., and Industrial Gas Co.—600 miles, planned, Reynosa, Tamaulipas, to Tampico-Poza Rica, Mexico.

Trans-Canada Pipe Lines, Ltd.—Proposed, Alberta to Toronto to Montreal.

Venezuela Atlantic Transmission Corp.—195 miles, 10-12-16-in., under way, El Placer near Las Mercedes, State of Guarico to Caracas, La Guaria, Maracay, and Valencia. Contracted by Williams Brothers, de Venezuela, S.A., B. E. Barnes, manager.

Westcoast Transmission Co., Ltd.—1,110 miles, 24-in., planned, Dawson Creek, D. C., through Pine Pass and Fraser River Valley to Kamloops, Princeton, and Vancouver to Portland. Ford, Bacon & Davis, engineers.

280 miles, 20-in., planned, Pincher Creek to Montana on to Spokane, Wash. Ford, Bacon & Davis, engineers.

138 miles, 20-in., planned, Sumas to Tacoma, Wash.

139 miles, 18-in., planned, Tacoma, Wash., to Portland, Ore.

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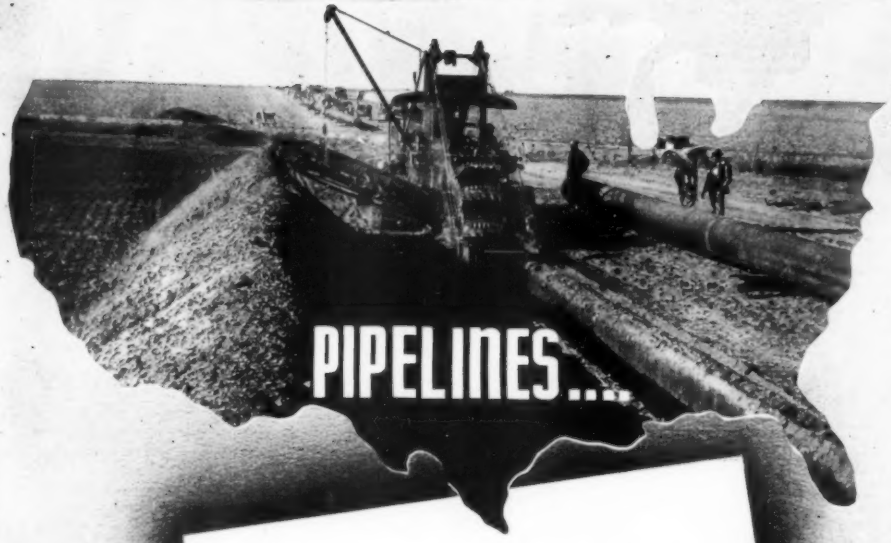

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PIPE LINES

Trunk Extension

Texas Eastern to lay 315-mile gas line into Texas

SHREVEPORT. — Texas Eastern Transmission Corp. revealed plans last week for a 315-mile, 24-in. southwestern extension of its main Mississippi-to-Pennsylvania natural-gas trunk system which is still under construction.

The company told stockholders at its annual meeting in Wilmington, Del., that it had filed with the Federal Power Commission for approval of the $26,000,000 project.

The new line, scheduled for completion and operation by November 1, would tie in with the company's 20-in. line at Castor, La., and extend southwest to the vicinity of Provident City, Tex., the terminus of Texas Eastern's 16-in. line in that area. Initial capacity, with one 5,500-hp. compressor station planned near Center, Tex., would be about 200,000,000 cu. ft. of gas per day.

R. H. Hargrove, company president, said the project would insure adequate supplies of gas for the system and provide a base for future increases in capacity at minimum cost.

Wilcox system.—At Provident City, it is reported that gas will be delivered to the Texas Eastern system by Wilcox Trend Pipe Line Co., organized by Harry Bass Drilling Co. (Dallas) interests.

This firm is said to be planning construction of approximately 100 miles of big-inch line, including 70 miles of 22-in., and shorter sections of 14, 16, and 18-in., plus a 4 to 12-in. gathering system.

System capacity would be from 100 to 150 million cubic feet of gas daily.

Complete to Ohio.—Meanwhile, construction and testing of Texas Eastern's new 791-mile, 30-in. line has been completed from Kosciusko, Miss., to the Kentucky-Ohio crossing of the Ohio River.

Hargrove said the line now is in operation delivering gas to the Appalachian area through connections with Columbia Gas System.

The rest of the line is scheduled for completion this summer. When it is in operation, the company will gradually build up deliveries to about 400,000,000 cu. ft. of gas per day.

The total delivery capacity of the firm will then exceed 1.2 billion cubic feet of natural gas per day.

About the same time the line was being completed to the Ohio, Texas Eastern announced construction of a multichannel microwave system which will provide communication between the general offices in Shreveport and all points along the new line to Connellsville, Pa., and on to Linden, N. J.

The system will boast 56 stations and is approximately 70 per cent complete. The network also should be in operation this summer. B. D. Goodrich, vice president and chief engineer of the firm, said telemetering equipment will be installed.

United to Tap Production In Mustang Island Field

CORPUS CHRISTI. — United Gas Pipe Line Co. will lay 36 miles of pipe to tap gas production in Mustang Island field in Corpus Christi Bay off Ingleside, Tex.

The new line will have a capacity of 130,000,000 cu. ft. of gas daily and will extend from a purchase-meter station off Ingleside to a connection with United's system near Refugio, Tex.

The $2,735,000 project was approved late in April by the Federal Power Commission.

United will buy gas from Sunray Oil Corp., developer of the area. At the FPC hearing United said that reserves of gas in place in the field as of November 1, 1951, were 1,214.5 billion cubic feet. Of this, United's purchase contract with Sunray is estimated to cover 318.6 billion cubic feet.

United will use the additional gas to serve existing customers. The company's system is located in Alabama, Florida, Louisiana, Mississippi, and Texas.

Mexico Confirms Texas-Ohio Gas-Imports Negotiations

MEXICO CITY.—Antonio J. Bermudez, director of Petroleos Mexicanos, Mexican Government oil organization has confirmed Texas-Ohio Gas Co.'s announcement that negotiations have been going on for about 3 months relative to Pemex supplying gas for Texas-Ohio's proposed big trunk line.

Bermudez said no firm contract had yet been signed but that Pemex is definitely interested in an export deal. He said Mexico has sufficient gas to satisfy all domestic demands plus an important surplus for export.

The Texas-Ohio agreement, if it is realized, he said, would benefit Mexico in several ways. Dollars received for exported gas would be plowed back into construction to expand the country's network of gas lines. Though Mexico has all the gas it can use and then some, he said, the basic

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problem is the lack of pipe for lines to carry the gas to consuming centers.

The proposed deal involves purchase by Texas-Ohio at the international boundary of about 20,000,000 cu. ft. daily of gas produced in the state of Tamaulipas *(The Oil and Gas Journal, April 28, page 131)*.

Texas-Ohio has filed with the Federal Power Commission in Washington for approval of the imports, and it is believed that a deal will be worked out quickly if FPC goes along.

A hearing currently is under way on the company's proposal to build a 1,350-mile, 30-in. trunk line from Texas to West Virginia.

Hope Natural Plans Line to Hook Up New Gas Production

WASHINGTON. — Hope Natural Gas Co. has revealed plans to build a 33-mile natural-gas line in Virginia and West Virginia to connect new sources of gas.

In an application filed with the Federal Power Commission here, Hope said that the 8, 10, and 12-in. line would connect with its existing system in Wyoming County, West Virginia, and extend south to fields in Buchanan County, Virginia.

Part of the gas would be purchased from independent producers in Buchanan County. The remainder would come from Hope's own production now available in McDowell County, West Virginia.

Capacity of the line, Hope said, would be approximately 20,000,000 cu. ft. per day. No new markets or areas would be served, but service to present customers should be improved, the company said.

Pipe-Line Briefs

Platte Pipe Line Co. has decided to establish permanent headquarters in Kansas City, Mo., in late summer or early fall. The company, which is now located in Independence, Kans., chose Kansas City on the basis of a survey conducted by Ford, Bacon, and Davis, consulting engineers of New York, which showed that this midwestern metropolis offered the most in the way of operating economies. This was true not only for the Platte organization but for the five oil-company owners. Headquarters at Independence will be maintained until construction of the line is completed.

Montana-Dakota Utilities Co., Minneapolis, plans to build a 2,640-hp. compressor station in Butte County, S. D., to expand its service in the Black Hills area of South Dakota. The company has filed an application with the Federal Power Commission for the proposed $752,927 station. The new installation would contain four 660-hp. compressor units.

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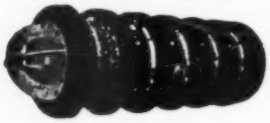

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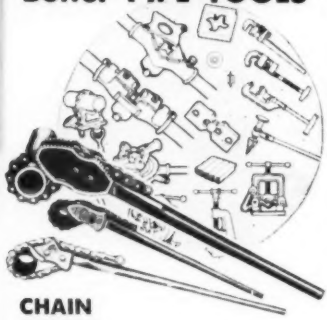

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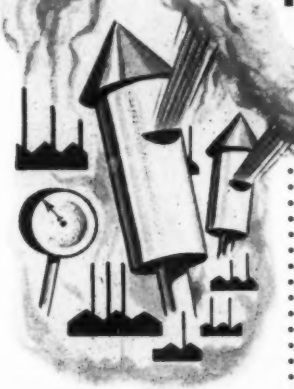

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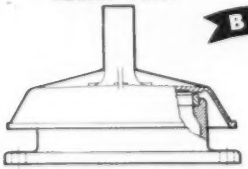

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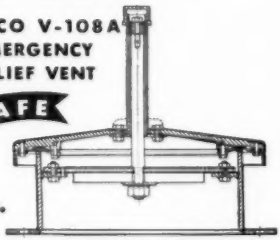

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NATURAL GAS

House-Heating Expansion Controls Seen as Permanent

WASHINGTON.—Natural-gas sales in general never again will be conducted in a market of uncontrolled house-heating expansion, it was predicted recently by Oscar W. Morton, director of the gas operations of the Petroleum Administration for Defense.

Speaking before a meeting of the engineers of state public-service commissions, Morton expressed the opinion that some degree of control over growth will be exercised from now on, presumably by the state authorities. The only reason for the exercise of such contol by PAD or any other federal agency is national defense he said, and when defense needs no longer press the federal Government promptly should step out of the picture.

Morton told the engineers that there are sound reasons for continuing PAD Order No. 2 through next winter, disclosing that possible serious situations did not occur during the past winter only because the weather was warmer than normal and peak demand came on weekends and at a favorable time when storage was nearly full.

Had the winter been colder than normal and the peak day occurred near the end of the week and near the end of the season, at a time when storage had been depleted, he said "we should have faced a serious loss of defense output and an extensive and dangerous shortage of residential service over large areas."

Lion to Build $31,000,000 Anhydrous Ammonia Plant

NEW ORLEANS.—Lion Oil Co. has revealed that it will build a $31,000,000 anhydrous ammonia plant in the greater New Orleans area.

The new plant, located at Luling, approximately 14 miles north of New Orleans, will use natural gas both as raw material and fuel, and from it will produce about 300 tons of anhydrous ammonia daily. The Texas Co. will supply the natural gas from its holdings in the immediate area.

In addition to producing ammonia, the plant also will expand Lion's nitrogen-producing facilities by approximately 53 per cent. Lion currently produces about 10 per cent of the nation's commercial output of synthetic nitrogen products at its El Dorado, Ark., plant, according to T. M. Martin, company president.

Financing arrangements for the plant, which already has received an accelerated tax-amortization certificate for 50 per cent of the cost from the Defense Production Administration includes a $15,000,000 loan from The Equitable Life Assurance Society and the offering of 400,000 shares of additional common stock by Lion.

DPA Sets New Carbon Black, Chemicals Expansion Goals

WASHINGTON. — Expansion programs have been announced by the Defense Production Administration calling for an increase by January 1, 1955, of 423,000,000 lb. a year of ethylene oxide over production as of January 1, 1951; 327,000,000 lb. of ethylene glycol; and 800,000,000 lb. of carbon black.

Ethylene oxide is a basic material for ethylene glycol, of which a 220,000,000-lb. increase will be required for permanent antifreeze.

World requirements for all types of carbon black are estimated at 2,464,000,000 lb. by 1955, and the expansion program will bring United States capacity up to 2,320,000,000 lb.

Flare Order Protested

AUSTIN.—The Texas Railroad Commission will sit here this week to consider validity of objections to its new order requiring monthly reports on all gas flared in Texas.

The May 6 hearing, requested by Humble Oil & Refining Co., and Magnolia Petroleum Co., will take up protests that the order requires duplication of some reports already required. The companies also said that the new regulation should be revamped to allow either the producer or purchaser to file the report, instead of placing the burden directly upon the producer.

Natural Gasoline

Tex Harvey Proposes L.P.G. Storage in Midland County

AUSTIN. — Tex Harvey Gasoline Co. recently revealed plans here for a 120,000-bbl. L.P.G.-storage project in Tex Harvey field, Midland County, Texas.

At a hearing before the Texas Railroad Commission, Clyde M. Keithly, Austin consultant, told Commission Examiner Charles Slack that the company would wash out four 30,000-bbl. cavities at about 2,050 ft. in a 540-ft. salt formation.

The four storage wells would be drilled on the company's tank farm where the salt formation is encountered at 1,560 ft. and is topped by 20 ft. of dense cap rock.

Keithly said Tex Harvey expects a minimum 95 per cent recovery on reproduction.

In leaching out the cavities, the company plans to circulate fresh water at a rate of about 2 bbl. per minute with a possible increase to 5 bbl. per hour in about 2 weeks. Salt water, to be used in displacing L.P.G. on reproduction, would be stored in surface pits.

Lone Star Lets Contract For Fort Chadbourne Plant

MIDLAND.—Lone Star Producing Co. has awarded contract to Gasoline Plant Construction Co., Houston, for construction of the company's recently announced gasoline plant in Fort Chadbourne field of West Texas.

The plant will cost an estimated $3,000,000. It will be located about 10 miles northeast of Bronte and 10 miles west of Winters.

Products will be natural gasoline, propane, and butane, and the plant will also include facilities to use residue gas for repressuring. Processing capacity is 30,000,000 cu. ft. of casing-head gas per day.

More than 22 miles of 2 to 16-in. pipe will be laid initially to gather gas from the first-stage separators serving producing wells in the field.

Fort Chadbourne field, in the extreme northwest section of Runnels County and northeast Coke County, was shut down February 1 by order of the Texas Railroad Commission to stop excessive flaring of gas.

Southern Production, Humble To Build New Pledger Plant

SHREVEPORT.—Southern Productoin Co., Inc., and Humble Oil & Refining Co. are planning construction of a new gasoline plant in Pledger field, Brazoria County, Texas, to take care of increased gas production in the field.

The field had marketed only a limited quantity of gas before Southern Production and Humble signed a 20-year, $100,000,000 agreement late last year for the exchange of natural gas from Texas and Louisiana fields.

The new plant will replace an older one, now too small, and will have a processing capacity of about 150,000,000 cu. ft. per day.

Liquids extracted from the company's gas, and also from gas produced for Humble; will go to Southern Production's account.

Present plans do not call for operation of the plant before 1953.

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Among the Drilling Contractors

California Firm Moves Rig In Remarkably Fast Time

Pike Drilling Co. crews recently made fast time in moving a rig and spudding in on a new location in Elk Hills field, according to Gene Graham, vice president and general manager of the firm. A 9,000-ft. rig was torn down, loaded out, moved to a new drill site, rigged up, and spudded in slightly less than 29 hours. Normal expectation for this operation is about 48 hours. The Los Angeles concern has three rigs at work for Standard Oil of California in Elk Hills, all engaged in developing the Stevens zone.

New Alberta Drilling Firm

Pennant Drilling, Ltd., a subsidiary of Signal Drilling Co. of Oklahoma, has established offices in Calgary, and its second rig arrived April 15.

Officers of the new firm are: C. E. Wright, president; F. M. Stevenson, vice president; William Glasscock, resident manager, and B. G. Kegley, drilling superintendent. All but Glasscock are from Tulsa.

55 Drilling Co., Ltd., has been awarded contract for a southeast offset test to the Naco Blood venture which found some oil in Madison last year. The test, for the Sweetgrass-Matlo group, Decalta Oils, Ltd., and MayGill Petroleums, Ltd., will be located on LSD 13, 19-7-22w4 on the Blood Indian Reserve in southwestern Alberta.

Devon Drilling Co. will drill 5 Scurry-Malmo on LSD 9, 15-44-22w4, in the Malmo area, Alberta, for Scurry Oils, Ltd. The new well site is about ¾ mile north of the Scurry group's dual zone Devonian discovery well.

Palmer Drilling Co. has been awarded contract for an extension test to the Viking sand gas discovery in the Elrose area of Southwest Saskatchewan by Sohio Petroleum Co. This new site is about 1 mile northeast of the gas discovery well, and some 90 miles southwest of Saskatoon.

Owen Rives, Holdenville, Okla., contractor for K. A. Ellison 1 Ross, SW SW SW 20-16n-2e, Lincoln County, Oklahoma, is drilling below surface casing on a 5,300-ft. Wilcox sand test.

L. Kellogg & Sons, Long Beach, will drill two wildcats for Hancock Oil Co. northwest of Gosford in Kern County, California. Rotary was being rigged for 43-14 Kern County Land in 14-30s-26e, and north of Cuyama Valley, San Luis Obispo County, 1 Santa Maria Land Co.-Arnold also was being started. Location of the latter is in the Edgar anticline area, 4-32s-19e.

New Edmonton Contractor

T. R. Cairns of Edmonton has announced the formation of a new contracting firm, Cairns Drilling Co., Ltd. The firm will carry out contract drilling and participate in development operations in western Canada. Associated with Cairns in the firm are: R. W. Stewart of Edmonton and Jack Cairns of Vancouver.

Mustang Drilling Co., Tyler, Tex., is drilling for Plymouth Oil Co. at 4 Gray-Bryson, a newly started Rodessa pay well in 7-17n-15w, in the Greenwood field, Caddo Parish, northwestern Louisiana.

Jimmy Petkas Drilling Co., Houston, is moving in on George E. Farenthold, Corpus Christi, 1 James T. Touchstone, San Patricio County wildcat, 5 miles west of Sinton, Tex. Test is slated for 7,000 ft.

Mangum Drilling Co., Houston, rigged up on La Gloria Corp. 1 H. G. Ritchie wildcat, 10 miles northeast of Taft, Tex., in San Patricio County, where they will drill to 7,000 ft.

Kirkpatrick Drilling Co., Corpus Christi, moved in on the 7,000-ft. wildcat in Starr County, Texas, 13 miles northeast of Rio Grande city. The test is 1 La Brisa Land & Cattle Co., being drilled for Sun Oil Co.

Big 6 Drilling Co., Houston, has moved in rig for B. Schlosberg 1 J. J. Murphy estate, scheduled 6,000-ft. wildcat, 15½ miles southwest of Victoria, Tex. Test is in Juan Flores Survey A-29, Victoria County.

Falco Drilling Co., Alice, Tex., has moved in for Tri-Mark Oil Co., Corpus Christi, 2 Julian Vela Pena, proposed 3,400-ft. Jim Hogg County, Texas, wildcat, 30 miles southwest of Hebbronville.

Exploration Drilling Co. has the rotary contract to drill an 8,500-ft. Spraberry wildcat in south-central Midland County, Texas, for Horvath Mills, Inc., and George Roche, Jr., both of New York. The wildcat location is 8 miles northwest of Spraberry production in the Midkiff field, 660 ft. from north and west lines of

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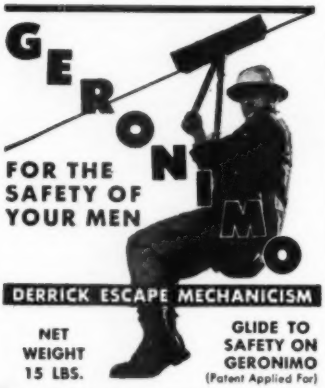

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Section 10, Block 39, T-4-S, T&P Survey, 17 miles south of Midland. The prospector will be drilled as the 1 Wilson Bryant.

Pike Drilling Co., Los Angeles, is contractor for Vega Corp. 1 Fred W. Frost, a wildcat in Yoakum County, Texas. The well is immediately adjacent to Landon pool.

Kemp Drilling Co., Shreveport, is contractor for a projected 9,600-ft. test at Sun Oil Co. 1 Eva M. Hurst in 8-1s-17w, Pearl River County, Mississippi. Sun has surveyed location and is moving in rig for the wildcat operation, 2 miles south of Sandy Hook field, Marion County, and about 2 miles east of Angie field, Washington Parish, Louisiana.

Murfin Drilling Co., Wichita, is contractor for Davis Bros. 1 Farrell, NE NE NW 32-9s-22w, Graham County, Kansas, wildcat. The new start is part of a 40-well wildcat program initiated in March by Davis Bros. of Tulsa.

Prime Drilling Co., Oklahoma City, is contractor for a scheduled Pawnee County, Kansas, wildcat, Davis Bros. 1 Wurm, NW NW NE 34-23s-16w. Prime will also drill 1 Falloon for Davis Bros. in SE SE NE 19-10s-27w, Sheridan County, Kansas, and 1 Kircheck in NW NW NE 7-11s-22w, Trego County, Kansas.

Serio Drilling Co. has the contract for Barnett Serio and Gulmon & Johns 1 Godbold, C NE NW 9-7n-8e, new Wilcox wildcat in Concordia Parish, East Central Louisiana.

Pam-Kar Drilling Co. is contractor for National Cooperative Refinery Association and Brunson Drilling Co. 1 Aley, NW NW NW 6-15s-15w, southwestern Russell County, Kansas, new wildcat 4 miles northwest of Donovan pool in the southwest corner of the county and 2 miles southeast of Kuntz pool in Ellis County.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area—	Week ended 4-28-52	Change week ended 4-21-52	Change week ended 4-30-51
Gulf Coast	597	—12	+ 64
N. & W. Tex.-N. M.	1,045	—20	+203
Ark.-N. La.-E. Tex.	148	+ 3	+ 6
Oklahoma	315	—35	+ 6
Kansas-S. Nebraska	146	—10	— 11
Illinois-Eastern	115	+15	— 11
Rocky Mountain	185	— 1	+ 69
Pacific Coast	160		+ 10
Total United States	2,714	—60	+336
Western Canada	140	+ 6	+ 25
Total	2,854	—54	+361

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and in North and West Texas-New Mexico area and in Oklahoma-Kansas are shown on pages 334 and 335.

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Falmouth, Mass.—Wm. F. Bennett, 53 Minot St.
Houston—Henry H. Paris Distributor, Inc., Box 932
Kansas City, Mo.—Wm. J. Hebenstreit, 3122 Coleman Rd.
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Minneapolis—Lin J. Krause, 200 Lumber Exchange
Narbeth, Pa.—J. W. Worthington, 105 Forrest Ave.
Newark, N. J.—Murray Eskin, Industrial Office Bldg.
New York—Henry Stein, 50 Cliff St.
Portland, Ore.—Earl H. Jones & Co., 1233 NW 12th Ave.
Richmond, Va.—P. C. Abbott & Co., Mutual Bldg.
San Francisco—Earl H. Jones & Co., 1150 Folsom St.
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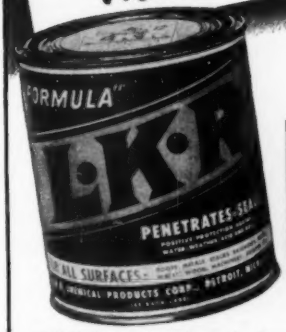

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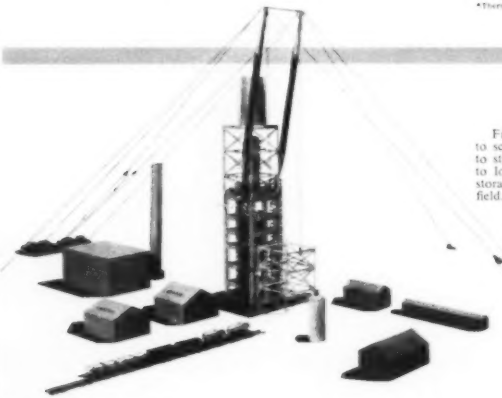
It took 60 years to save three months

on Socony's new cat-cracker*

The cat-cracker, the most important processing unit in a refinery today, is usually built from the ground up like a skyscraper—one or two floors at a time. But Fluor has developed a new time-saving technique of designing the component parts so that they can be fabricated on the ground simultaneously and lifted into place, thereby making more efficient use of manpower and equipment. Construction crews work in perfect coordination on a production-line basis to effect substantial savings in construction costs, but above all *in time!*

Fluor designed and constructed the catalytic cracking unit shown here for Socony-Vacuum at Augusta, Kansas. It stands 268 feet high, equivalent to a 22-story building. Nine months and 13 days after foundation was poured, it went on stream for 15,000 barrels a day, three months earlier than could be normally expected if built by conventional methods under similar circumstances. This airlift TCC unit processes about 1½ million barrels of oil in three months; that's why getting it into operation in the shortest possible time was an all-important objective.

*Thermofor catalytic cracking unit built for Socony-Vacuum Oil Company at their Augusta, Kansas refinery.



First, an experimental model was built to scale to check basic rigging design, to study actual erection problems, and to locate the most efficient work and storage areas before starting work in the field. The unit stood 5½ feet high.

October 26

Reinforced concrete was used to a height of 100 feet for fire protection. While the base was being poured (August 21, 1950), these concrete panels weighing 85 tons each were being cast on the ground slab.

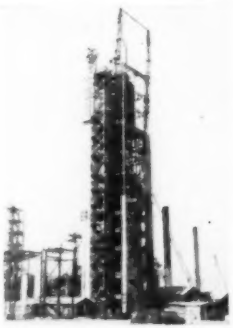
Here's how it was done— from conception to *Completion*

December 22

In spite of sub-zero weather, the building marathon continues. The Reactor weighing 100 tons is being hoisted 100 feet into the air. It took less than an hour to complete this operation. The cracking process takes place in this unit.

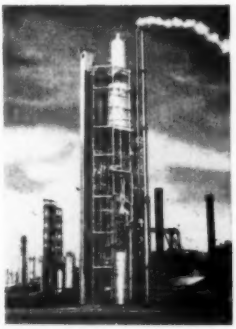
January 4

This steel section, assembled on the ground and weighing 110 tons, was lifted 160 feet and lowered into place over the Reactor. It supports the Hot Catalyst Bin. This is one of 28 major lifts varying in weight from 60 to 125 tons.



March 5

After the last steel section was set, the Separator Surge Drum (63 tons) is raised into place on top. This was the last lift to be made. Total height is now 268 feet, 22 stories high, and is one of the tallest structures in Kansas.



May 10

Operation testing completed and ready for start up, 9 months and 13 days after foundation was finished. This cat-cracker is capable of processing 630,000 gallons of oil every day. Fluor has four more similar units under way.

For 60 years Fluor has been building for industry and is among the leaders in plant construction for the oil, gasoline, chemical and power industries in and out of the continental United States. If time-saving is your concern, take time to contact your nearest Fluor district office for details. Write for Bulletin CC2521 describing Fluor activity in the construction of Fluid and Thermofor cat-crackers.

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REFINING

Malco Buys Plant

Expansion set for 1,500 bbl. refinery at Prewitt

PREWITT, N. M.—Malco Refineries, Inc., of Roswell, N. M., has completed negotiations for the purchase of the 1,500-bbl. refinery here, formerly owned by Petroleum Products Producing & Refining Co.

Robert O. Anderson, president of Malco, said last week that Malco has contracted for a catalytic reforming unit, to be built by Grebe & Doremus Process Co., Houston, under license with Atlantic Reforming Co. Construction of new and enlarged thermal cracking facilities and catalytic polymerization units also will be started immediately.

The new facilities will expand capacity of the refinery to 5,000 bbl. daily when the program is completed this September. The plant will be designed so that it can be expanded to run at least 10,000 bbl. daily as crude production and market demand for products increase, Anderson said.

Line purchased.—The purchase agreement also took in a 31-mile, 4-in. crude line, and surveys have been started for a 60-mile extension of this line to reach the new Pettigrew Tocito field in northwestern New Mexico. The line and plant will serve the San Juan basin and northern Arizona.

Malco plans future construction of two new products lines—one to run 100 miles to Albuquerque, where the company has taken an option on a terminal site, and the second to extend about 60 miles west to Lupton, Ariz.

The company hopes to have the Albuquerque line in operation by the end of 1953.

The purchase agreement went into effect May 1. Consideration was not disclosed.

Indiana Standard Contracts Wood River Alcohol Plant

WOOD RIVER, Ill.—Standard Oil Co. (Ind.) has let contract to M. W. Kellogg Co., refinery and chemical plant engineer-contractors, for construction of its large isooctyl alcohol plant at the refinery here.

Three units will comprise the plant. They include a fractionation system for obtaining heptane as a heartcut from an olefin feed stock, a refinery gas reformer for preparation of hydrogen, and carbon monoxide and the actual isooctyl alcohol section where the heptane, hydrogen, and carbon monoxide are synthesized into the end product.

Design for the first unit is Indiana Standard's. The other two will utilize Kellogg designs.

The plant will produce about 10,000,000 lb. of the alcohol annually. The product is used primarily in the manufacture of plasticizers.

New Phenol Plant O.K.'d

PORT NECHES, Tex.—Jefferson Chemical Co.'s new nonyl phenol and dinonyl phenol plant, now under construction here, has been granted a certificate of necessity by the Defense Production Administration.

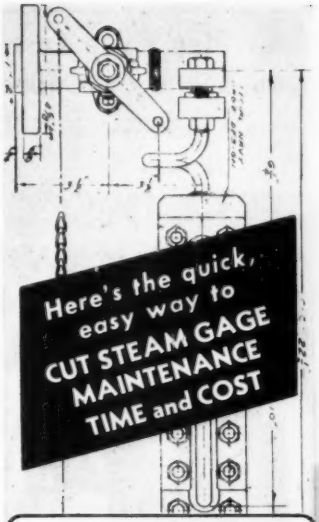
Construction of the new manufacturing facilities will be completed

NELSON REFINERY CONSTRUCTION INDEX

Appears in the first issue of each month.
Explanation—Cost-imating No. 61, December 15, 1949, pages 91, 92.
Compiled by W. L. Nelson—Refinery Consultant—Tulsa.
Indexes of Individual Equipment Items—January, April, July, October.

INDEX (1946 = 100)

	1948	1949	1950	1951	Jan. 1952
Centrifugal pumps	120.0	118.9	128.1	136.2	136.2
Reciprocating pumps	138.1	144.6	143.9	182.4	183.3
Compressor	128.0	120.0	118.8	138.1	138.1
Engines	120.0	115.5	117.9	137.1	137.1
Motors	112.7	114.0	130.8	148.8	148.8
Transformers	116.0	116.0	116.0	130.5	130.5
Instruments	120.0	122.0	127.8	142.3	142.4
Miscellaneous equipment avg.	122.1	121.6	126.2	145.1	145.2
Materials component	139.3	143.6	149.5	164.0	162.7
Labor component	128.0	137.1	144.0	152.5	156.7
Refinery construction index	132.5	139.7	146.2	157.2	159.1



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within the next 2 or 3 months. It was begun in September last year.

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Tentative Program Set Up For A. P. I. Lube Meeting

TULSA.—A tentative program for the meeting of the lubrication committee of the American Petroleum Institute to be held here May 26-27 has been announced by B. J. Symon, Shell Oil Co., Inc., New York, chairman of the committee.

Seven speakers have signed for the general session May 27 and the banquet meeting that evening. Addresses and authors are:

"Oil Business, 1952-1953," E. T. Knight, economics department of Atlantic Refining Co.;

"Choose the Oil for the Service," M. D. Gjerde, manager of sales technical service for Standard Oil Co. (Ind.) and chairman of S.A.E. fuels and lubricants technical committee;

"Designations for Lubricating Oils for Automotive Type Engines," Harry C. Mougey, research-laboratories division of General Motors Corp.;

"Factors in the Additive Treatment of Oils for A.P.I. Service MS," A. Bruce Boehm, Enjay Co., Inc.;

"The Importance of Lubrication to Industry Management," D. F. Hollingsworth, E. I. du Pont de Nemours & Co., Inc.;

"Lubricants and Their Importance to the World," R. W. McDowell, president of Mid-Continent Petroleum Corp.;

"Science on the World Front," Dr. Harold Vagtborg, president of Southwest Research Institute.

Symon said that the operating committee would meet May 26 and the business meeting will be held May 28. Further discussion of the new motor-oil designations and an educational program to put the new designations across to the petroleum and automotive industries and the public are scheduled for further discussion during the business meeting.

Sinclair Buys Site for South Carolina Terminal

NEW YORK.—Sinclair Refining Co. has purchased a 25-acre tract south of Spartanburg, S. C., and will erect a modern bulk terminal for distributing products in parts of Georgia, North and South Carolina.

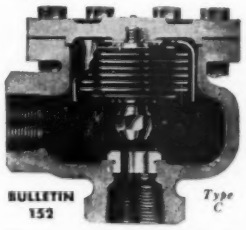
The company plans about 4,500,000 gal. of storage facilities for gasoline, kerosine, diesel and tractor fuel, and home-heating oil. Each tank will be equipped with fire-prevention and vapor-recovery units and will have a remote-control, electric-motor-driven loading pump with a capacity of 600 gal. per minute.

The terminal will be located near Southern Railway facilities and Plantation Pipe Line Co.'s system. Grading of the property is now under way and it is anticipated that the terminal will be receiving products from the company's Houston refinery through the Plantation line by the end of the year. About 2 miles of pipe will be required to connect the terminal tanks with Plantation's main-line system.

Nicholson Traps Help

Cut Annual Steam Cost $500,000

A large processing plant's campaign to improve heat transfer efficiency has resulted in a yearly saving of $500,000. Credit for a fair portion of this is given to the installation of Nicholson steam traps. 5 types for every plant use. Size ¼" to 2", press. to 250 lbs. For Nicholson features, Bulletin 152.



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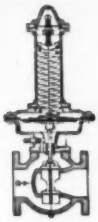

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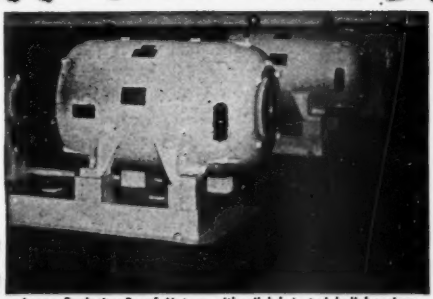
EXPLOSION-PROOF MOTORS
1 to 700 h.p.



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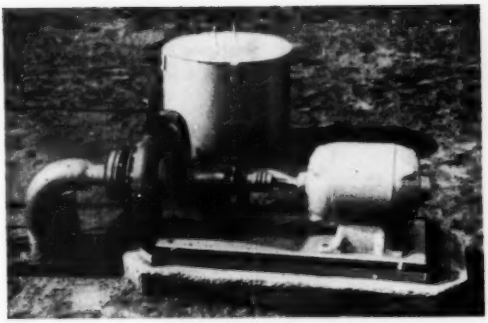

GOULDS Fig. 3750—Ball-bearing support-head type pump for direct drive or belt drive. Capacities to 3800 G.P.M. Heads to 400 ft.

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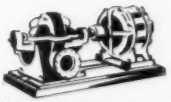
The Goulds "Support-Head" centrifugal pump pictured above is handling water for drilling operations of a major oil company in a New Mexico field. With a few minor changes this pump could be used for transferring seal oil, circulating crude oil, refinery plant pumping or a number of other jobs. It is only one of a diversified line of Goulds Pumps being widely used throughout the oil industry.

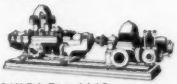
Such features as long service life, low maintenance costs, interchangeable parts and a broad range of ratings at maximum efficiency are the chief reasons for Goulds acceptance by oil men. *To get more information about this "Support-Head" centrifugal pump Fig. 3750 check with your Goulds distributor or write for Bulletin 715.1.*

Other Adaptable GOULDS Pumps for the Oil Industry



GOULDS Fig. 3450—Double-suction, single-stage Goulds centrifugals. Up to 15,000 G.P.M. Heads up to 560 ft. Bulletin 721.2.

GOULDS Fig. 1813—"New Pyramid" double-acting piston pumps come in six sizes with capacity ranges from 7 to 58 G.P.M. Heads up to 580 ft. Bulletin 601.



GOULDS Fig. 3360—High pressure multistage centrifugal. Full range of capacities and pressures. Bulletin 722.5.

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The Basin of Babel

TERMINOLOGY of the oil-bearing section in the central part of that roughly triangular, asymmetric, structural basin of northwestern Colorado, southwestern Nebraska, southeastern Wyoming, and the extreme northwestern corner of Kansas, has become so confused that something must be done to alleviate its growing pains.

The confusion started soon after Ohio Oil Co. opened the area with its discovery well at Gurley field in 1949. Since that time at least six sets of names for the producing section in the center of the basin have come into being. As each of these sets has its adherents, only a quick review of the accompanying table is needed to imagine the degree of confusion that now exists.

The reasons for such a variation of nomenclature and regional correlations are easily explained. (1) The sands found at depth do not necessarily have counterparts in the outcropping rocks of the Rocky Mountains or the Black Hills with which some of the earlier correlations were made. (2) The section under consideration was laid down on the unconformable Jurassic-Morrison surface by a transgressive sea and the sands are lithologic units, some of which cross time lines. (3) Fossils are scarce in the rocks of this section—only recently has a means for picking a variety of characteristic fauna from the shales been developed.

Because of these handicaps to easy correlation, the rapid and initially spotty development in the basin resulted in "hurried" nomenclature tailored to get the job done in a given locality. Now after 3 years of development drilling it has become obvious how misleading some of the terminology can be.

The alphabet-labeled sands were one way to get around inadequate knowledge of the area during initial development and they served their purpose very well. However, as development spreads out, the continued use of alphabet nomenclature can result only in confusion as more and more or fewer and fewer sands are found in the newer areas; these labels can never be of much value in regional studies.

A new correlation was broached at the Los Angeles meeting in a paper

"D"	FIRST DAKOTA	GURLEY	MUDDY	UPPER MUDDY	1st	GURLEY	OMADI
"G"	SECOND DAKOTA	HUNTSMAN			2nd		
	HUNTSMAN					HUNTSMAN	
"J"	THIRD DAKOTA	NEWCASTLE	DAKOTA	MUDDY OR NEWCASTLE		CRUISE	
	SKULL CREEK	SKULL CREEK	FUSON	SKULL CREEK		SKULL CREEK	
"M"	FIRST	FALL RIVER		DAKOTA			BAKKEN GROUP
"O"	SECOND	FUSON	LAKOTA			CLOVERLY (UNDIVIDED)	
"R"	THIRD	LAKOTA		LAKOTA			
"T"	FOURTH						
	LAKOTA	JURASSIC-MORRISON					

prepared by Charles W. Sternberg, consulting geologist of Denver, and A. J. Crowley, Argo Oil Corp., Denver. This correlation (given in the extreme right column of the table) was built up from all available paleontological evidence. It was prepared after there had been a sufficient number of holes drilled in the basin to construct adequate cross-sections to follow sands from one cluster of development to another. It avoids detail that has not been thoroughly worked out and thus will not result in confusion as additional stratigraphic work is done. The authors of the paper state, "even with our limited faunal knowledge, the electrical characteristics are so distinct that correlations can be carried through the central part of the basin with a great deal of certainty. Under the circumstances, we have no hesitancy in suggesting the terminology here set out as valid and less confusing, and we urge its adoption."

Most geologists of the area are ready to adopt this terminology. Many have long realized that the terminology they are using needs overhauling, but they are not likely to do any revising until they are convinced the revision has official sanction. So, it looks as though the time has come for some organization of geologists to form a committee to decide on a uniform, workable terminology for the Dakota sands in this basin.

While the committee is meeting it also might decide what name should be given this basin which is now called Denver, Julesburg, Denver-Julesburg, or Denver-Cheyenne. The way things stand now, "the basin of Babel" is most appropriate.

Philip C. Ingalls.

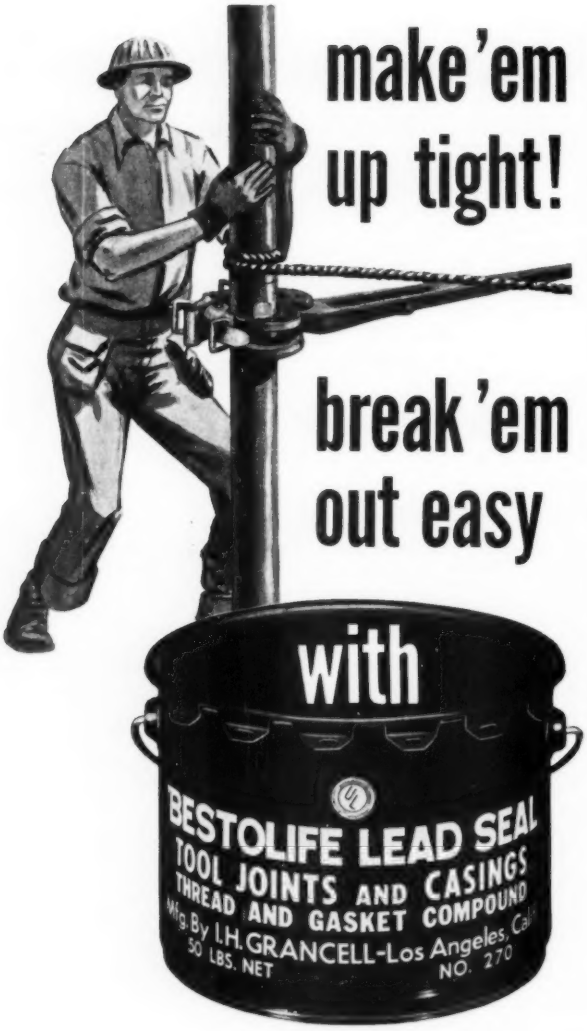
HIGHLIGHTS OF WEEK'S DEVELOPMENTS

CANADA.—The third new gas discovery of the year for Saskatchewan was made in the Battle Creek area, 17 miles north of the United States border, flowing 6,500 M.c.f. of gas daily from the Jurassic during initial drill-stem tests. The thirteenth gas discovery for 1952 in Alberta was recorded in the Eaglesham sector of the Peace River region.

OKLAHOMA.—The northern Oklahoma portion of the Anadarko basin developed further interest as one discovery was completed, an assured discovery was testing for completion and two locations were announced.

ROCKY MOUNTAIN AREA.—Stanolind Oil & Gas Co. found gas in the upper Muddy at the Chappel wildcat, Sedgwick County, Colorado, moving Denver-Julesburg basin production farther east in Colorado. Amerada Petroleum Corp. has suspended operations at the Keene area, North Dakota, wildcat after failing to establish production in the Madison.

WEST TEXAS.—Superior Oil Co. 4-16 Windham, wildcat northeast of Ellenburger and Pennsylvanian production in Pegasus field, developed 5,265 ft. of free oil at 12,352-485 ft. in the Devonian, and oil and gas-cut mud at 12,509-90 ft. in the Silurian.



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California

Deep Oil Discovery Due At Torrey Canyon

LOS ANGELES.—Union Oil Co. appeared to be on the verge of a deep oil discovery at Torrey Canyon in the Santa Clara Valley area of Ventura County. The 83 Torrey, in the old Torrey Canyon field 3 miles south of Piru, was being swabbed at last reports, following the setting of 7-in. casing at 9,326 ft.

Scout reports indicate the deep wildcat may establish production in nonmarine Sespe sands, which were first discovered by shallow Torrey Canyon wells in 1889. Underlying marine Miocene and the overlying marine Eocene, the thick, steeply dipping Sespe formation outcrops at several points in this area. It is productive at Torrey Canyon and four other nearby fields, all of which are associated with the Oak Ridge uplift.

In the La Habra area near Whittier, Los Angeles County, a new fault-block pool was added. Located about ¼ mile southeast of the Bering area of Sansinena field, Universal Consolidated Oil Co. 1 Curtis was completed flowing about 200 bbl. daily from 4,850-5,288 ft., total depth. Location of the new discovery, which was in a deeper sand than the Bering wells, is NE NE 31-2s-10w. Universal was scheduled to start 2 Curtis by the weekend.

About ½ mile southwest of Mountain View field, Kern County, Universal 13-23 Easton also indicated it would make a well. On a drill-stem test at 5,490-5,550 ft. the potential extensioner yielded 175 ft. of gas-cut oil and mud after the tool was open 1 hour. Following the test Universal started coring ahead for the main portion of the Chanac. Location of 13-23 Easton is SW SW 23-30s-28e.

Near Arvin on the southeast end of Mountain View, The Texas Co. 6 George was abandoned at 6,660 ft. to give that area its first dry hole since its discovery last July. The abandoned well, in NW NE 23-31s-29e, was an eastern edge test. At 2 Kern Valley Farms, 1¼ miles to the northwest, Texaco was preparing to deepen the 6,212-ft. north-edge well. The extensioner was completed about 1 month ago as a small producer.

Of the several new wildcats announced, four were in Kern and Santa Barbara counties. About 2 miles southwest of Fruitvale field, Standard Oil Co. of California will drill 48 Shellabarger. Located in SE SW 30-29s-27e, it will be a Stevens zone test. Northwest of Devils Den production, in NW NE 10-25s-18e, M. J. M. & M. will drill 1 Alferitz. The two Santa Barbara wildcats were Jeff Dye Drilling Co. 1 Capitan, 2 miles east of Capitan production in 34-5n-30w; and British American Oil Producing Co. 1 Rancho Suey in the Tepusquet area, 5-10n-32w.

Shell Oil Co. announced it will drill 47X-19 Bliss in 19-9s-15e, 6 miles northeast of the Chowchilla gas field in Merced County. Shell also has staked 36X-28 Elfers in 28-5s-7e, about 5 miles west of Patterson in Stanislaus County; and 37X-13 Mabury was staked northwest of Blackwells Corner production in 13-26s-18e.

CALIFORNIA SUCCESSFUL WILDCAT

Monterey County, ½-mile east extension to San Ardo field: Standard Oil Co. B-14-5 Alexander, SW SW 5-23s-11e, pumped 92 bbl. per day through perforations at 2,492-2,618 ft., 11°-gravity crude, TD 2,618 ft., elev. 854 ft.

CALIFORNIA WILDCAT FAILURES

Fresno County, Camden area: Lebow McNee Oil Co. 1 Qualls, 6-17s-20e, dry, TD 6,114 ft., elev. 249 ft.

Coalinga area: Humble Oil & Refining Co. 1 A. M. Domengine, 27-18s-15e, dry, TD 5,124 ft., elev. 733 ft.

Kern County, Arvin area: The Texas Co. 6

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George, 23-31s-29e, dry, TD 6,660 ft. elev. 474 ft.

Goosloo area: The Texas Co. 2 KCL-Goosloo, 29-29s-25e, dry, TD 10,194 ft., elev. 312 ft.

Poso Creek area: Hathaway Company 1 Hunt, 28-27s-27e, dry, TD 3,940 ft., elev. 583 ft.

San Benito County, Hollister area: General Pet. Corp. 1 O'Connel-Ranch 11-12s-4e, dry, TD 4,656 ft.

Vallecitos area: Commercial Oil Co. 1 McDonald, 24-16s-10e, dry, TD 2,004 ft., elev. 1,520 ft.

San Luis Obispo County, Creston area: Dielectric Laboratories, Inc. 1 Courtney, 16-28s-14e, dry, TD 820 ft., elev. 1,403 ft.

Cuyama area: Richfield Oil Corp. 1 Shlaudeman, 23-11n-28w, dry, deepened from 3,234 ft., TD 3,606 ft., elev. 1,836 ft.

Eastern Texas

Sandusky-Oil Creek Extension Scheduled

DALLAS.—An extension try east of Sandusky-Oil Creek field has been scheduled by Magnolia Petroleum Co. as its 1 F. H. Bailey, located on a 107-acre tract in the James Coryell Survey, A-261. Projected depth was 9,800 ft. Location falls about midway between 7,200-7,900-ft. production in Sandusky field, and the new gas-distillate producer in Big Mineral Creek field, which found a rich wet-gas section just below 10,000 ft.

Star Oil Co. 1 R. M. Brooks, deep wildcat 3 miles northeast of Sadler, was drilling in shale below 8,365 ft.

Seitz, Comegys & Seitz 1 Kate Poffenbach, wildcat in the Alfred Berry Survey, was drilling in shale at 5,100 ft.

In Wood County, Trans-Tex Drilling Co. completed its 1 R. F. Walker as a sub-Clarksville sand discovery. Potential was 30 bbl. of low-gravity oil a day.

Hamilton-Powell Drilling Co. prepared to deepen 1 Fred Loshe, Fannin County wildcat north of Bonham, from old total depth of 6,400 ft. to 9,000 ft. Elevation of the test is 565 ft.

F. W. Carr 1 Sawyer, discovery 1 mile north of Athens in Henderson County, was waiting on potential after flowing 47 bbl. of oil in 10 hours from perforations in the Bacon limestone at 8,293-99 ft.

Kemp Drilling Co. 1 Reed & Bitner, Marion County, was building tanks. The well recovered 43° -gravity oil from the Pettit limestone on drill-stem test and was reported to have flowed immediately after perforating from 6,566-72 ft. Location is northwest of Woodlawn field which produces high-gravity distillate from the Pettit.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURES

Angelina County: C. H. Alexander 1 C. Bradley, T. C. Caro Sur., dry, TD 5,504 ft.

B. G. Byars 3 Angelina County Lumber Co., T. Caro Sur., dry, TD 4,754 ft.

Fannin County: Callery & Hurt 1 R. G. Robinson, S. M. Rainer Sur., dry, TD 5,580 ft.

Grayson County: Kerr-McGee Industries 1 Hollingshead, Velasco Sur., dry, TD 5,400 ft.

Shell Oil Co. 1 Mary Funk, J. McCarty Sur., dry, TD 7,045 ft.

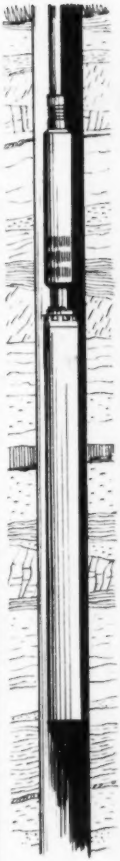
Hunt County: B. B. Banner 1 D. A. Steele, H. C. Hale Sur., dry, TD 3,131 ft.

Hayden Farmer Drilling Co. 1 M. L. Thompson, M. Beauman Sur., dry, TD 4,502 ft., elec. 450 ft., Paluxy 4,290 ft.

Panola County: Rock Hill Oil Co. 1 J. D. Woolworth Unit, J. Laramore Sur., dry, TD 6,570 ft.

Rains County: R. J. Caraway 1 Jenkins Shipp, A. Woodring Sur., dry, TD 12,490 ft., elev. 492 ft., Paluxy 6,160 ft., Massive anhydrite 7,523-7,678 ft.

Red River County: American Union Pe-



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troleum Co. 1 Grady Gibson, D. Johnson Sur., dry, TD 2,430 ft., elev. 527 ft., Travis Peak 2,050 ft.

Canadian Fields

Saskatchewan Reports Third Gas Discovery

CALGARY—A sizable natural gas discovery has been made in the Battle Creek area of southwest Saskatchewan, at a wildcat being drilled by the team of Albercan Oil Corporation, Imperial Oil Ltd., and Calvin Consolidated Oil & Gas Company, Ltd. The gas discovery was made in the Jurassic formation, and flowed at rates up to 6,500,000 cu. ft. daily during initial drill-stem tests.

The new strike, Saskatchewan's third gas discovery so far this year, was made at Imperial-Canada Southern-Federated Co-op-Calvan 4-31-3-26 Battle Creek well, on LSH 4 3101-26w-3. Site is 3 miles north of Nashlyn railpoint, and 45 miles south of Maple Creek town. It is in the far southwest sector of the province, being 17 miles north of the United States border and 23 miles east of the Alberta line. The Fosterton medium crude oil field is located about 90 miles to the northeast.

First drill-stem test in the Jurassic was run from 4,224-40 ft. A strong gas blow reached the surface in 2 minutes, and blew the mercury from the tube, so was unmeasured. Second test, from 4,235-43 ft., flowed natural gas in 2 minutes, at maximum rate estimated at 6,500,000 cu. ft. during 55-minute test. Third test, from 4,239-48 ft. for 47 minutes, flowed gas at rate 5,100,000 cu. ft. daily.

It is expected that further testing operations will be carried out at the Battle Creek well in the Jurassic, preliminary to heading down for the Devonian objectives.

Texaco Exploration Co. has found an encouraging oil showing, indicating a possible discovery at its Hamelin Creek area exploratory venture in the Peace River region of northwest Alberta. The strike was made in the Triassic formation, which also gave up a small flow of gas in addition to the oil showing.

The well Texaco A-1 Hamelin Creek on LSD 7 36-80-7w6, is about 2 miles northwest of Hudson's Bay-Union-Texaco No. 1 Cadomin formation gas discovery well and 65 miles southwest of Peace River town. Drill-stem test in the Triassic interval 3,867-78 ft. gave a gas flow (immeasurable) to the surface in 55 minutes and a 2-hour pipe recovery of 170 ft. of clean oil, no water. Second test, from 3,877-83 ft., yielded a 1-hour pipe recovery of 30 ft. of oil-cut mud and 1,440 ft. of slightly salty water. Drilling is being continued.

Phillips Petroleum Co. of Oklahoma has struck a moderate flow of natural gas at its wildcat in the Notikewin River area of northwest Alberta. This wildcat venture discovered its gas during drill-stem test in the Gething formation, and also gave up some salt water.

The well, Phillips 1 Branch on LSD 12 14-91-4w6, 65 miles northwest of Peace River town, contacted the Gething at 2,663 ft. or 324 ft. subsea. Thirty-minute drill-stem test from 2,663-92 ft., flowed natural gas to the surface in 2 minutes, at rate of 670,000 cu. ft. daily, and sprayed mud and salt water in 23 minutes. Pipe recovery was 480 ft. of salt water. Second test in the Gething, from 2,703-42 ft. gave up a recovery of 840 ft. of salt water in 20 minutes.

Canadian Gulf Oil Co.'s discovery well in the Nevis area, about 90 miles northeast of Calgary, has commenced production testing, and produced at the rate of 336 bbl. daily during test on restricted choke. Gas-oil ratio was high during that first test, and crew is currently continuing testing operations.

The well, Gulf 2 Lampert, on LSD 4

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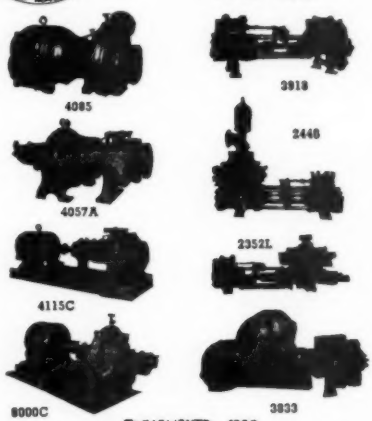

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32-38-22w4, is about 14 miles west of Stettler Devonian oil wells. The discovery well found crude oil, with gravity of 39.7° in the D2 zone of Devonian, in addition to yielding natural gas flows at rates up to 12,000,000 cu. ft. daily, plus naphtha recovery.

CANADIAN SUCCESSFUL WILDCAT

Tor Royalite 2 Bonnyville, LSD 9 29-61-4w4, TD 1,045 ft. capped gas well.

High Crest-Albermont-Leduc Consolidated 1 New Norway LSD 16 23-44-22w4, TD 5,180 ft. D2 Devonian IP 162 bbl. oil daily.

CANADIAN WILDCAT FAILURES

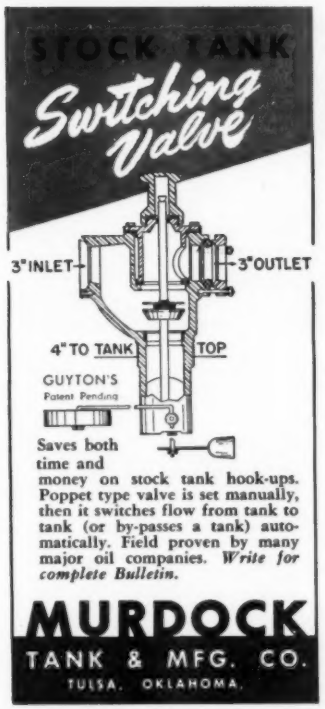
Husky-Phillips 1 Pine, LSD 6 34-35-25w4, TD 3,275 ft.

Imperial 8-11 Red Earth Creek, LSD 8 11-87-8w5, TD 4,663 ft.

EASTERN CANADA

In Elgin County, Western Ashley Minerals, drilling on the Thomas Morrison farm ½ mile south of Wardsville, is finishing with a gas flow from the Guelph-Niagara formation estimated at 2,000,000 cu. ft. Western Ashley is also drilling on the Morton property, between Concessions 1 and 2 Aldborough.

In Aldborough township, midway between Rodney and Wardsville, Richfield Oil & Gas Co. of Chatham, is finishing a shallow oil well, estimated by Geologist J. A. Beattie as one of the best completions in this area. It is the sixth producer drilled by Richfield in the Rodney district.



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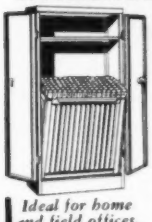

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Ouachita Parish Strike Awaits Official Test

SHREVEPORT.—Official test is due at Feazel Interests and Monla Gas Co., Inc., 1 Breece Lumber Co. in Section 3-18n-5e, new Cotton Valley gas-condensate strike 1½ miles east and slightly north of Swartz, Ouachita Parish. The well flowed 8,000 M.c.f. of gas daily through ¾-in. tubing choke. Flow had an unestimated amount of condensate. Production is from perforations in the Bodcaw sand of the Cotton Valley at 7,352-72 ft.

The new discovery is more than 28 miles east of the nearest Cotton Valley sand production and opens a wide area to be explored.

The Texas Co. has indications of a new oil field at 1 A. J. Gamble, C NE SW 19-13n-14w, De Soto Parish, 1½ miles northwest of Grand Cane. Latest reports from the field state that the well is flowing oil through a small choke from perforations between 4,218-24 ft. opposite a sand series in the Paluxy.

Magnolia Petroleum Co., Shreveport, has staked location and taken permit to drill 2 A. Wasson, C NW SW 18-22n-4w, each offset and first try at confirmation of Summerfield field, Claiborne Parish. The location is 2,700 ft. east of the discovery well, 1 A. Wasson. Production will be sought to 11,000 ft. to test Smackover lime.

The California Co. staked location for 1 Long Bell Petroleum Co., Inc., proposed 10,500-ft. Wilcox wildcat. The new trial is located in 9-1n-3w, 3 miles southwest of Melder, Rapides Parish.

H. L. Hunt et al are drilling below 471 ft. at 1 C. F. Farrar, confirmation to Barnett Serio's 1 Burrell, recent Concordia Parish discovery.

Justiss Mears Oil Co. et al are preparing to begin drilling operations at 1 C. E. Evans et al, new wildcat to be drilled about 3½ miles southwest of Bonita, Morehouse Parish. The location is 2,392 ft. from east line and 935 ft. from south line of 15-22n-7e. The well will be taken to the Cotton Valley at about 4,000 ft.

Arkansas.—W. G. Skelly is reportedly trying to regain circulation at 9,000 ft. in 1 Dickson heirs, 1,295 ft. from north line, 1,424 ft. from west line in Section 36-19n-27w, wildcat in southeastern Miller County. The hole is bottomed at 11,076 ft. Circulation was lost when well found gas kick in the Smackover while coring.

A slight show of gas and oil has been found in coring the Rodessa at Stanolind Oil & Gas Co. 1 Oscar Kochtitzky, NE NE 9-18s-27w, wildcat 2¾ miles northeast of Fort Lynn field, Miller County.

A slight show of gas in lime from 6,184-89 ft. was found, lime showing pinpoints of oil from 6,271½-80 ft., and sand lime with slight gas odor from 6,284½-94 ft. Coring is continuing below 6,355 ft.

LOUISIANA SUCCESSFUL WILDCAT

Ouachita Parish: W. C. Feazel et al 1 Breece, 113 ft. N and 165 ft. E SWc NW 3-18n-5e, flowed 8,000 M.c.f. of gas per day from Bodcaw 7,352-72 ft., TD 7,980 ft. (discovery tentatively named Schwartz).

LOUISIANA WILDCAT FAILURES

Caldwell Parish: D. D. Feldman et al 1

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Hatten-Ford, C SW SW 20-15n-4e, dry, TD 7,831 ft.

Catahoula Parish: Hunt Oil Co. and Amerada Petroleum Corp. 1 Louisiana-Central, C SW NE 3-10n-6e, dry, TD 5,025 ft.

Concordia Parish: Serio, Gulman & Johns 1 C. B. Godbold, C NE NE NW 9-7n-8e, dry, TD 6,509 ft.

Red River Parish: Placid Oil Co. 1 L. F. Kirk, C NE SW 20-14n-8w, dry, TD 3,620 ft.

ARKANSAS WILDCAT FAILURES

Calhoun County: Alcan Oil Co. 1 Freeman-Smith Lumber Co., C NW SE NW 26-14s-15w, dry, TD 2,412 ft.

Miller County: Stanolind Oil & Gas Co. 1 Miller Land & Lumber Co. "B," 660 ft. N and 1,983 ft. W SEc 17-18s-27w, dry, TD 10,994 ft.

South Louisiana

Potential Test Run at St. Charles Discovery

NEW ORLEANS.—Potential test has been run at The California Co. 1 George Montgomery et al, 85-12s-19e, oil discovery in St. Charles Parish. From perforations at 10,250-78 ft., the well flowed 81 bbl. of 52.8°-gravity distillate per day plus 2,280,000 cu. ft. of gas. Flow gaged through 3/16-in. choke. Hole is bottomed at 11,600 ft. and has 7-in. casing set at 11,172 ft.

Superior Oil Co. has run a successful drill-stem test at 1 Rockefeller, 4-16s-3w, Cameron Parish wildcat. Well was perforated at 9,045-51 ft. and operator recorded a flow of 77 bbl. of distillate daily plus 7,474,000 cu. ft. of gas through 22/64-in. choke. Tubing pressure developed was 3,090 psi. and gravity of the distillate was 56.6°. Testing on the venture will continue.

Pan American Production Co. will complete 1 Andrepont, 42-8s-1w, wildcat in Acadia Parish which the firm took over and deepened and found production. On test, the well flowed approximately 100 bbl. of fluid daily from perforations at 9,268-78 ft. Fluid content was reported to be 40-50 per cent salt water. Flowing pressure on the test was 3,710 psi. and gravity of the oil was 33°.

In the Dulac area of Terrebonne Parish, it is indicated that Texas Gulf Producing Co. and Union Producing Co. 1 LaTerre Co. will be completed as a gas discovery. The venture was perforated at 14,152 ft. and it is reported that the well flowed gas. This wildcat is bottomed at 14,678 ft. in its third sidetracked hole.

Woods Oil & Gas Co. has run a successful test at 1 Slater, 6-18s-27e, Plaquemines Parish prospect, in the North Potash area. Through a 10/64-in. choke, the well flowed 110 bbl. of oil daily from perforations at 11,230-41 ft. under tubing pressure of 3,425 ft. This venture is credited with logging six possible gas-distillate pays from 11,015-11,238 ft.

A second well has been completed in Block 35 field off Plaquemines Parish at The California Co. 1 State Lease 1958, located in the Battledore Reef area. The venture is credited with flowing 117 bbl. of 30.6°-gravity oil daily through 7/64-in. choke. Completion was made in the 7,500-ft. sand. This relatively new field lies within the boundary the federal government claims determines its limits of jurisdiction.

SOUTH LOUISIANA WILDCAT FAILURES

Beauregard Parish: Hassie Hunt Trust et al 1 Long Bell, 26-5s-9w, dry, TD 9,015 ft.

Plaquemines Parish: Richardson & Bass 1-E Texas Co.-Delacroix Corp., St. Le. 335, 36-15s-24e, dry, TD 14,500 ft.

St. Landry Parish: John W. Mecom 1 Willie Castille, 27-5s-5e, dry, TD 10,312 ft.

Mississippi

Wilcox Strike Assured In Wilkinson County

JACKSON.—Gulf Refining Co. is assured of a new Wilcox discovery in Wilkinson County, Mississippi, at 5 Crosby Lumber Co., 23-3n-2w. From casing perforations at 7,156-64 ft., the well tested wash water and a small amount of oil. Operator squeezed and reperforated at 7,160-66 ft. On 5½-hour test, the well flowed at the rate of 144 bbl. of oil per day through 11/64-in. choke. Tubing pressure was 300 psi. Choke was reduced to 9/64-in. and on 7½ hour test, the well flowed at the rate of 100 bbl. of oil per day. It will be recalled that oil shows were recovered in sidewall cores of Wilcox sand at 7,156-68 ft.

In Pollard field, Alabama, Humble Oil and Refining Co. cored an oil sand in Tuscaloosa massive sand section in 2 Moye, NW NW 18-1n-9e, direct west offset to the field discovery well. Oil sand was reported being cored at 6,090-6,109 ft., and sand with spotted show of oil at 6,109-24 ft. Casing was set to total depth of 6,175 ft. and operator perforated 6,092-6,101 ft. Tubing was run on packer and the well swabbed 70 bbl. of oil plus 35 bbl. of wash water in 10 hours. After being shut in overnight, the well flowed 18 bbl. of 26°-gravity oil in 5 hours through 3/16-in. choke. While it has not been confirmed, it is believed that operator will plug back and complete the well in top of lower Tuscaloosa, which is the sand in which the field discovery was completed.

A prospective new gas discovery in southern Forrest County, Mississippi, is Ohio Oil Co. 1 Coleman-Powe, 5-1s-12w. Although no details are being released on this wildcat, it will be recalled that gas

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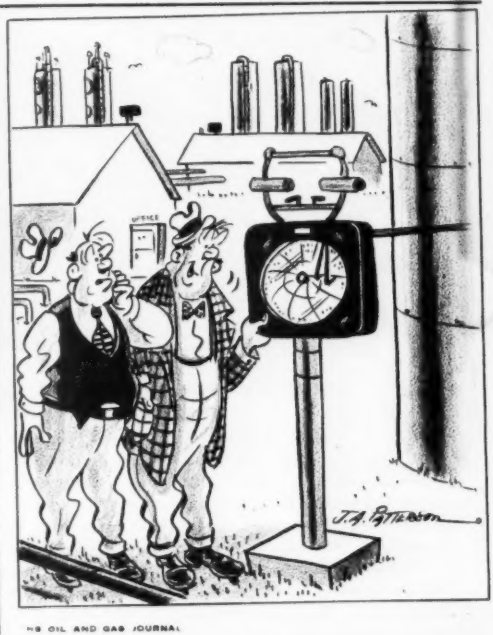

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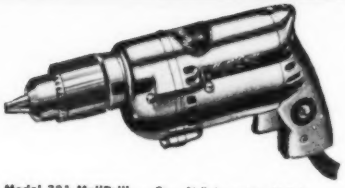

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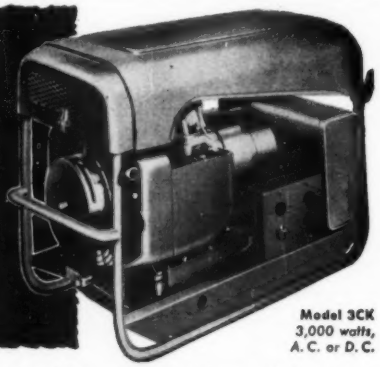

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and condensate were recovered on drill-stem tests at 7,194-7,200 ft., 7,200-07 ft., and 7,312-15 ft. It is reported that approximately 12 ft. of gas sand was present in the upper zone and 16 ft. in the lower zone.

Although Humble Oil and Refining Co. 1 Emma Williams et al, deep test in South Carlton field, Alabama, is releasing no information, rumors are persistent that shows of oil have been encountered in a deeper horizon than was penetrated in the field discovery well. The well is now shut down for repairs at total depth of 10,548 ft.

MISSISSIPPI WILDCAT FAILURES

Adams County: John S. Callon 1 Simon Moses Est. 14-8n-3w, dry, TD 6,309 ft.

B. Serio 1 Barksdale Est. 26-5n-3w, dry, TD 6,820 ft.

Franklin County: Robert Oil Co.-Lyle Cashion Co. 1 Herring-Herring-Gregory, 4-7n-2e, dry, TD 6,339 ft.

Yazoo County: Sistrunk - Latimer - Vasser Drilling Co. 1 J. S. Wise et al, 20-12n-2w, dry, TD 7,356 ft.

Kansas

Ellis County Dry Hole Reworked for Discovery

FLYNN OIL CO. has opened a new oil pool in Ellis County by reworking a well completed dry in 1950. The well, Flynn 1 Weisner, is in NW NW NW 36-12s-20w, about 4 miles east of Ellis pool.

The well was originally drilled to a total depth of 3,947 ft., 30 ft. into the Arbuckle. Flynn cleaned out the hole to 3,930 ft. and set casing on bottom. After perforating the interval 3,882-90 ft. opposite the conglomerate topped at 3,842 ft., 1,620 ft. of oil rose in the hole in 3 hours. Additional perforations were made of the interval 3,863-68 ft. and the well swabbed 5 bbl. hourly for 10 hours. This discovery is being put on the pump.

Another old hole yielded a new discovery when D. R. Lauck et al 1 Jones, NW NW NW 9-15s-31w, Gove County, swabbed 25 bbl. of oil per hour. This well is located about 20 miles north and east of Scott City and some 12 miles south of Lundgren pool. The original hole was dug to 5,027 ft. and completed dry. Lauck cleaned out the hole, perforated the Marmaton at 4,284-4,300 ft., and, after a 2,000-gal. acid treatment, swabbed 25 bbl. hourly for 4 hours. The discovery is being put on pump.

A Viola drill-stem test at 3,920-36 ft. in Cooperative Refinery Association 1-B Byers, SE SE NW 27-24s-12w, Stafford County, recovered 1,830 ft. of 40°-gravity oil and 270 ft. of muddy water in 30 minutes. This well was drilled ahead to the Simpson and a drill-stem test at 4,064-84 ft. recovered 1,140 ft. of gas and 122 ft. of heavily oil-cut mud in 30 minutes. This indicated discovery is drilling ahead to the Arbuckle. Top of the Viola was called at 3,918 ft. and top of the Simpson at 4,046 ft.

About 2 miles east of St. John Townsite pool in Stafford County Musgrove Petroleum Corp. 1 Manke, SW SW NE 2-24s-13w, recovered 170 ft. of oil and gas-cut mud on a 1-hour drill-stem test of the Viola at 3,881-3,921 ft. A shallower test of the Viola, at 3,841-52 ft., recovered only 27 ft. of slightly oil and gas-cut mud. Petroleum, Inc., 1 Ward, an indicated Arbuckle discovery about 3 miles northeast of St. John Townsite pool, is drilling cement for completion tests. This well, which recovered 270 ft. of free oil and 120 ft. of muddy oil on a drill-stem test at 3,811-19 ft. is surrounded by dry holes.

KANSAS WILDCAT FAILURES

Barton County: Lewis Drilling Co. 1 Pichner, SE SE NW 13-16s-11w, dry, TD 3,455 ft.

Ben Brack 1 Farrell, NE NE NW 19-17s-12w, dry, TD 3,412 ft.

Aladdin and Crowe 1 Hammeke, NW NW NE 9-19s-12w, dry, TD 3,435 ft.
Decatur County: Musgrove Petroleum 1 Mines, SE SE SW 11-2s-30w, dry, TD 4,320 ft.
Empire 1 Seely, SW SW SE 11-5s-27w, dry, TD 4,115 ft.
Gove County: Skiles Oil Co. 1 Peirano, SE SE SE 27-13s-27w, dry, TD 4,487 ft.
Graham County: Murfin-Appleman 1 Zeman "C," NE SE NE 26-7s-22w, dry, TD 3,891 ft.
H. Gore 1 Griffith, NE NE SW 2-8s-23w, dry, TD 3,955 ft.
Greenwood County: White & Ellis 1 Glasco, NE SW NW 11-28s-10e, dry, TD 2,543 ft.
Pawnee County: Jackson Drilling Co. 1 Crane, SW SW NE 4-22s-15w, dry, TD 3,980 ft.
Russell County: H. A. Horwitz 1 Shaffer, SW SW NE 2-13s-15w, dry, TD 3,215 ft.
Shelley-Miller 1 Price, SW SW NE 9-14s-13w, dry, TD 3,363 ft.
Keystone-Brunson 1 Steinert "B," NE NE SE 14-15s-15w, dry, TD 3,380 ft.
Sedgwick County: J. P. Gaty 1 Joseph, SW SE NW 24-25s-2e, dry, TD 3,283 ft.
Trego County: Victor 1 Larimer, SE SE SW 26-12s-25w, dry, TD 4,640 ft.

Central Area

ILLINOIS

In Wabash County, 5 miles northeast of Grayville, Calvert Drilling Co. has set casing to test the McClosky lime from 2,925-25 ft. at 1 M. W. Kleinschmidt, NE SE SW 23-2s-14w, ½ mile from production. Recovery on a 1-hour drill-stem test was 600 ft. of clean oil, and 510 ft. of salt water, having gassed in 16 minutes.

George & Wrather Oil Co. and Frank Lacy 1 Givens heirs, SE NW SE 31-7s-10e, 3 miles south of New Haven in Gallatin County, awaits cable tools to test the Aux Vases from 2,776-96 ft. Recovery on a 2-hour drill-stem test showed gas in 12 minutes, 300 ft. of clean oil, 30 ft. of mud-cut oil, 90 ft. of oil and gas-cut salty mud and 150 ft. of salt water. The well is ½ mile from production.

In Coles County Harry J. Adams 1 Herkermer in NW NW NE of 11-12n-7e, total depth 3,174 ft., tested the Devonian at 3,164-65 ft. and 3,143 ft. to get water and is plugging back.

INDIANA

In Posey County George S. Engle 1 Oscar Ries, SW NE SE 22-7s-14w, 4 miles southwest of Mt. Vernon, has been completed for 181 bbl. of oil a day on pump from the Cypress sand at 2,375-86 ft. The new area is 1 mile from other production.

In Knox County Frank Lyons 1 Lou Jenkins made 42 bbl. of oil per day from the Rosiclare lime at 1,497-1,505 ft. The new pay discovery in Monroe City pool is located in the southwest part of the pool.

O'Neal & Co. and O. B. Trotter 1 Darwin T. Woods in Gibson County, SE NW SW 9-3s-11w, 2 miles east of Owensville, swabbed oil at the rate of 143 bbl. daily from the Aux Vases lime at 2,370-76 ft. Total depth is 2,512 ft. The new well is a ½-mile extension of Owensville pool.

WESTERN KENTUCKY

Otis W. Greer 1 Clarence Conrey, SEc 22-O-32, Daviess County, got 70 ft. of oil fill in 2 hours after a 40-qt. shot in Tar Springs (Jett) sand from 540-48 ft. The well is located at the southeast edge of Whitesville.

In Henderson County Tuley & Carter and Iglehart 1 Royster, wildcat in 5-N-24, swabbed 4 bbl. of oil and same amount of water hourly after fracturing sand at 1996-2,005 ft. and is putting on pump.

EASTERN KENTUCKY

Location has been announced for a wildcat in far western Elliott County. Raymond Long et al will drill on the Nealy Gray lease in 16-T-76 on the Wyatt dome. Well is designed to test the Corniferous lime section and is ½ mile west of a dry hole.

In Letcher County, Kentucky West Virginia Gas Co. has completed 6037 W. R. Polly a wildcat south of the southern limits of Big Sandy gas field. At a total depth of 2,673 ft. the well gauged 292,000 cu. ft. of gas daily from the Big Lime formation. One offset has already been staked and another test is starting 4 miles to the south of this area.

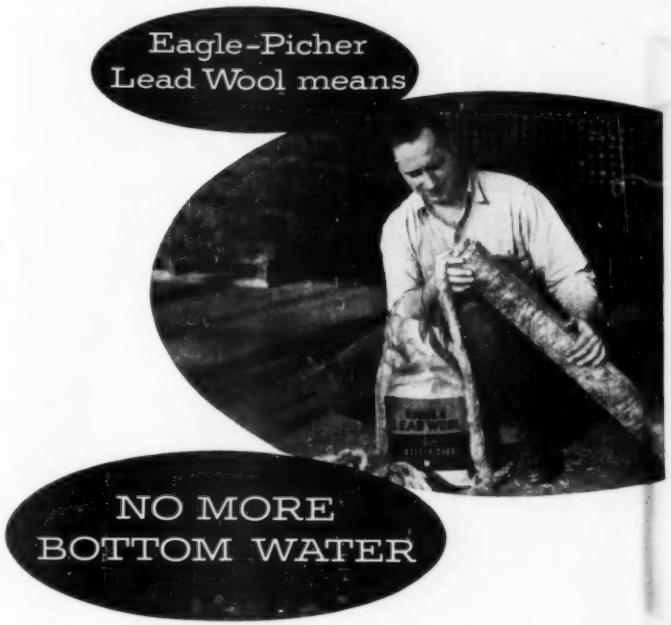
MICHIGAN

Clean-out and test of Richfield section at Sun Oil Co. 1 Iutzi et al, NW SW SW 5-19n-3w, Hamilton Township wildcat, Clare County, was delayed this week, awaiting arrival of cable tool spudder unit which was being shipped from Illinois, but was scheduled to be on location in Michigan shortly.

The 1 Iutzi was cased and cemented in with 5-in. pipe at 5,127 ft. after hole was surveyed with micro-log. Well was drilled through the Richfield into the black limestone to a total depth of 5,380 ft. Top of Richfield was logged at about 5,133 ft. and black lime was picked at about 5,329 ft. Well showed 3,000 ft. of free oil, 897 ft. of mud-cut oil and 180 ft. of salt water on a 5-hour drill-stem test in the Richfield from 5,125-5,239 ft. Gas showed on test in 7 minutes. It was reported that overall about 20 ft. of Richfield section showed for possible pay, but how much of this was effective oil pay had not been determined.

Brazos Oil & Gas Co. has abandoned test of a shallower potential oil pay section at its HE-1 State-Chester, C NE NE 15-29n-2w, Chester Township deep test wildcat, Otsego County.

After acid treatment and test, without successful results perforations at 5,913-39 and 5,952-80 ft. were squeeze-cemented off. What testing plans were now being con-



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sidered for this deep well had not been announced.

Brazos did spud its next 7,000-ft. Niagaran test in the area this week, at the HE-2 State- Chester, C NE SW 10-29n-2w. Surface casing was set at 873 ft.

ILLINOIS WILDCAT FAILURES

Christian County: Collins Bros. 1 Ira Traughker, SE NE SE 27-14n-1e, dry, TD 2,415 ft.

Clinton County: Ryan Oil Co. 1 Brink, NE NE SW 3-1n-2w, dry, TD 1,332 ft.

Edgar County: Cyril A. Bowles 4 Lange, SW SW NE 21-15n-13w, dry, TD 315 ft.

Gallatin County: Ashland Oil & Refining Co. 1 Harry Hines, SW NE SE 20-7s-10e, dry, TD 3,015 ft.

Lawrence County: Sam D. Jarvis 1 Lela Dowell, SE SE NE 25-5n-13w, dry, TD 1,067 ft.

Washington County: Irven Bassett Drilling Co. 1 Brammeyer, NW NE SE 33-1n-1w, dry, TD 1,513 ft.

Wayne County: Carter Oil Co. 1 Bunting, SW SE SE 2-2s-9e, dry, TD 3,477 ft.

INDIANA WILDCAT FAILURES

Knox County: Harris Oil Co. 1 Wright, SE SW NW 32-5n-7w, dry, TD 1,045 ft.

Pike County: L. P. Galambos 1 E. Leister, SE NW SE 1-1s-7w, dry, TD 2,710 ft.

Warrick County: O. L. Sturbois 1 Tooley, NE SW SW 14-6s-8w, dry, TD 1,612 ft.

James G. Brown 1 H. Thompson, SW SW SW 34-4s-6w, dry, TD 1,372 ft.

WESTERN KENTUCKY WILDCAT FAILURES

Christian County: Skiles Oil-White & Vickery 1 Ed Robertson, SE SE SW 21-H-23, dry, TD 737 ft.

White & Vickery 1 Faust, SW SE SW 19-H-23, dry, TD 670 ft.

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Muhlenberg County: Dr. J. G. Ellis 15 Brown heirs, SE NW SE 12-H-31, dry, TD 590 ft.

Union County: Magnolia Petroleum Co. 1 Hancock, NE SW SW 14-9-19, dry, TD 2,733 ft.

MICHIGAN SUCCESSFUL WILDCAT

Clare County, Winterfield Township: Sun Oil Co. Randall et al N½ NW SW 1-20n-6w, Traverse 3,125 ft., 40 bbl. oil and show of water from perforations at 3,120-35; 3,162-3,220; 3,264-74 ft., TD 5,180 ft. (dry in Dundee & Richfield), PBTD 3,330 ft.

MICHIGAN WILDCAT FAILURES

Allegan County, Saugatuck Township: Wm. J. Morris 1 Paulin, NE SE NW 11-3n-16w, Traverse 1,361 ft., dry, TD 1,411 ft.

Cass County, Calvin Township: Louis Maxfield, Trustee 1 Carter, NW SE SE 1-7s-14w, Traverse 932 ft., dry, TD 950 ft.

Kalkaska County, Boardman Township: Michigan Cities Natural Gas Co. 1 Rauh, NE SE NE 33-26n-8w, dry in Richfield, TD 4,296 ft.

Kent County, Sparta Township: Clarence N. Crawford 1 Swenson & England, SE SW NE 3-9n-12w, Traverse 2,307 ft., dry, TD 2,360 ft.

Montcalm County, Reynolds Township: Clem Glavin 1 Cole et al, SW SE SE 7-12n-10w, Reed City zone 3,272 ft., dry, TD 3,370 ft.

Oceana County, Golden Township: Max Spidel 1 Riggs, NE SW NW 27-15n-18w, Reed City zone 2,300 ft., dry, TD 2,328 ft.

Appalachian-Ohio

West Virginia Reports All Gas Completions

PITTSBURGH—In Elk district, Kanawha County - West Virginia, United Fuel Gas Co. 11-7109 Numa Block Coal Co., gaged 4,525,000 cu. ft. gas, natural, in the Oriskany sand, TD 5,217 ft. Union district, Preston County, Cumberland & Allegheny Gas Co., announced location for a deep test, the 1-488 Walter E. Nine, elevation 2,098 ft. This is approximately 2,390 ft. south of 464 Clarence Jones. Williamsburg district, Greenbrier County, Deep Rock Oil Corp. 1 Bretha H. Thornbury et al, elevation 2,420 ft., topped the Oriskany sand at 6,429 ft. and is drilling at 6,441 ft. Gore district, Hampshire County, T. M. Pettigrew et al, after deciding to leave 1 John Timbrook open at 6,790 ft., and to move to a new location, have resumed drilling and are at a depth of 7,109 ft.

Maryland. Garrett County: Loch Lynn Corp. 1 Lester White will be acidized at a depth of 3,503 ft. The 1 Nellie Lee will be cased at a depth of 3,439 ft. where a fishing job was completed. Ray Kite 1 Alvin Friend, after drilling to a depth of 3,783 ft., will also run casing. Eberly & Snee 3 Eli Beechie is still shut down at 4,362 ft., and the gas now tests 340,000 cu. ft. The chert was recorded in this well at 4,076 ft., and the Oriskany sand at 4,190 ft. New York State Natural Gas Corp. 2-N-247 is the deepest drilling well in this county at the present time and is at a depth of 5,947 ft.

Southwest Pennsylvania Unity Township, Westmoreland County: Peoples Natural Gas Co. 4003, A. J. Dotterway, elevation 2,094 ft., is cementing crooked hole at 3,965 ft., No. 4008 J. R. Frola, drilling at 472 ft.

OHIO

J. W. Swingle et al have probably found a new gas pool in Newton Township, Muskingum County, 1½ miles north of a small oil well, and 1 mile east of a small gasser. Their 1 Walter Ferington, Section 22, logged

Clinton at 3,490-96 ft. with 150,000 cu. ft. and sand at 3,504-32 ft., with an additional 40,000 cu. ft. which gaged 1,336,000 cu. ft. when shut-in the casing after a 120-qt. shot.

The Status Development 1 Joseph Bortos, Lot 4, Sandy Township, Tuscarawas County, gauged 950,000 cu. ft. natural with a rock of 1,100 lb. from white Clinton at 5,068-86 ft.

Two producers were completed in Jackson Township, Knox County: in the new Mt. Zion pool, Davis and Wray 1 Virgil Wolfe, Section 18, made 30 bbl. natural and 235 bbl. in 24 hours after shot from sand at 2,939-89 ft.; in Bladensburg pool, Allen Willey et al 1 Robert Melick, Section 15, made 40 bbl. in 24 hours after shot from Clinton sand at 2,724-71 ft.

OHIO WILDCAT FAILURE

Portage County, Ravenna Township: Ed Obermiller et al 1 Charles Willard, Lot 4, Clinton 4,227-84 ft., TD 4,317 ft.

Texas Gulf Coast

Montgomery County Discovery Completed

HOUSTON.—Two miles west of Conroe, Austral Oil Exploration Co., Inc., has completed I K. R. Randall for a new oil discovery in Montgomery County. From the Yegua formation at 4,778-82 ft., the well has been completed for 105 bbl. of 33°-gravity oil per day through 12 64-in. choke. Tubing pressure registered 1,280 psi. on the test. This wildcat, located in Denward James Survey, Abstract 289, is bottomed at 8,248 ft. and operator set 5½-in. casing at 4,844 ft.

Alex Head and Kirkwood & Co. have tested gas and distillate at 1 Stella Woytek, wildcat in Hallettsville field, Lavaca County. From lower Wilcox perforations at 8,450-56 ft., gas and distillate were recovered with tubing pressure of 2,400 psi. This wildcat was originally drilled by Forrest Oil Corp. and abandoned at 8,008 ft. in 1947. It is located in James Campbell League 2, Abstract 6.

Also in Lavaca County, Cities Service Oil Co. 1 Koehn Unit, 6 miles west of Sheridan, flowed 200,000 cu. ft. of gas per day plus 120 bbl. of salt water from perforations at 9,680-94 ft. When tool was pulled, recovery was 270 ft. of 55°-gravity distillate and 540 ft. of salt water. Surface pressure reached 800 psi. A previous test at 9,720-30 ft. had recovery of 53°-gravity distillate. Testing will continue on the venture.

New pay has been established on the east flank of Nash salt dome, Fort Bend County, at Michel T. Halbouty & Carl Casey 1-C Kittie Nash Grove. From perforations at 4,100-14 ft., the well has been potentialed for 76 bbl. of 22.8°-gravity oil daily through 8 64-in. choke. Tubing pressure was 300 psi. and casing pressure 450 psi.

In Fulshear field, Fort Bend County, The Texas Co. 2 Bertha Busch has opened a new pay at 7,067-69 ft. On potential test, the well flowed 43 bbl. of 37.2°-gravity oil daily through 8/64-in. choke. This new sand opener is located in I. G. N. RR. Survey, Abstract 262, and establishes the fourth pay for the field.

A new Fayette County oil discovery is completing at Sutton Drilling Co. 2 E. A. Arnim, shallow wilcox producer 2 miles northeast of Arnim field. Operator is erecting tanks at the discovery after recovering oil on drill-stem test at 2,150-55 ft. Location is in William Kuykendall Survey, 5½ miles northwest of Flatonia.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Bee County: oil discovery—Stanolind Oil & Gas Co. 2 Florence McCollom, A. Jackson Davis Sur., TD 8,620 ft., perf. 7,564-70 ft., IP 23 bbl. oil per day, 36° gravity, TP 1,635 psi.

Goliad County: gas condensate discovery—

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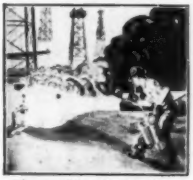
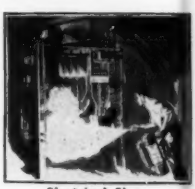

Flammable Liquid Fires

Gas Fires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Wrather Petroleum Corp. 1 Mrs. M. Lutenbacher Est., Four League Grant, TD 5,591 ft., perf. 5,572-28 ft., IP 2,700,000 cu. ft. of gas per day, plus condensate.

Hardin County: oil discovery—Shell Oil Co. 1 Kirby Lumber Corp. Tract 110-A, H&TC RR Sur. 219, A-327, TD 7,503 ft., perf. 7,074-86 ft., IP 19 bbl. oil per day, 8/64-in. choke 18.6° gravity, TP 1,220 psi.

San Jacinto County: new pay at Cold Springs—Commercial Petroleum & Transport Co. D-10 Fostor Lumber Co., George Taylor Sur., TD 12,287 ft., perf. 10,112-32 ft., IP 1,300,000 cu. ft. of gas per day, open flow, SIP 2,680 psi.

Gas condensate discovery—Stanolind Oil & Gas Co. 1 Emily Langham, S. S. Lanier Sur. A-200, TD 10,510 ft., perf. 10,201-08 ft., IP gas-distillate well, no gage.

Wharton County: gas discovery—Grubb & Hawkins 1 The Bronson Home, John Bridges Sur. A-73, TD 5,815 ft., perf. 4,387-92 ft., IP 7,500,000 cu. ft. of dry gas per day, open flow, SIP 1,677 psi.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Bee County: Selby Walker Corp. 1 Zeno Barber, C. B. Shain Sur., 3 mi. N of Mineral, dry, TD 750 ft.

Fort Bend County: Carnes W. Weaver 1 John Mulvihill et al, Samuel Kennedy Surv., dry, TD 8,258 ft.

Galveston County: Sun Oil Co. 2 State Tract 340, in Galveston Bay Tract 340, dry, TD 9,526 ft.

Goliad County: B. Schlorsberg 1 F. Curtis, Henry Winchester Sur., A-44, dry, TD 5,600 ft.

Jackson County: J. P. Petkas 1 L. Chappel, Thos. Menefee Sur., dry, TD 6,010 ft.

Jefferson County: Progress Petroleum Co. of Texas 1 C. Doornbos, D. Easley Sur., Sec. 3, A-20, dry, TD 7,417 ft.

Caroline Hunt Sands 1 M. T. Schlicer et al, M. Chirino Sur. A-10, dry, TD 9,503 ft.

Karnes County: Fletcher Oil Co. 1 Annie Zamzow, Britton Odom Sur. A-220, dry, TD 8,504 ft.

Lavaca County: Wesley West 1 Peter C. Krupp, Thos Carral Sur. A-107, dry, TD 5,550 ft.

Matagardo County: Brazos Oil & Gas Co. 1 Hattie LeTulle, Ralph Wright Sur. A-407, dry, TD 5,861 ft.

Montgomery County: Falcon Seaboard Drilling Co. & Roy Gardner 1 William Rice Institute, J. E. Lewis Sur. A-665, dry, TD 9,012 ft.

Orange County: American Republics Corp. et al 1 Lutcher & Moore Lumber Co., Geo. A. Pattilo League, A-20, TD 10,353 ft.

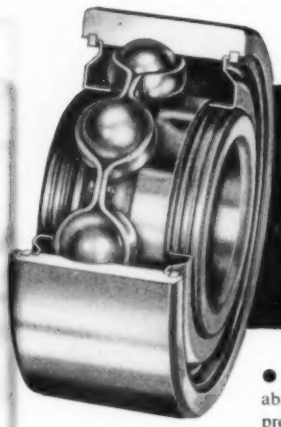
Polk County: Jordan Drilling Co. & Kraftex Enterprises, Ltd., 1 Lelia, LaFollette, G. S. Thomas Sur. A-72, dry, TD 8,500 ft.

Wharton County: J. B. Ferguson 1 Lacy W. Armour, Thomas Westfall Sur. A-65, dry, TD 6,442 ft.

Grubb & Hawkins 2 Emil Cihal, J. W. Nueva Sur., A-314, dry, TD 5,762 ft.

H. L. Hunt 1 Mary E. Rankin, ET RR Co. Sur. A-128, dry, TD 7,500 ft.

Albert Plummer 1 Guy F. Stovall, H&TC RR Sur., Cert. 290, Sec. 28, dry, TD 7,585 ft.



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North-Central Texas

Extension in Prospect For South Belcherville Field

WICHITA FALLS.—A north extension to South Belcherville field of Montague County was in prospect as George S. Engle 1 Reed had flowing oil on a drill-stem test at 5,355-79 ft. According to reports, oil reached the surface in 13½ minutes but there was no estimate on the amount.

Jack Grace Production Co. has scheduled a test for the new South Belcherville area as his 1 M. B. Ritchie, in Block 65, M. Garrett Survey. The 6,000-ft. test is 2 miles south of the town of Belcherville.

Tom B. Medders 1 Ernst Egenbacher, 3½ miles southeast of Bowie, completed as a Strawn sand discovery. Pumping potential was 131 bbl. of oil a day from pay at 5,224-32 and 5,233-41 ft.

Seaboard Oil Co. completed its 1 C. W. Lambkin as a southwest extender and third producer for the Northwest Hilton area of Nolan County. Calculated daily potential was 198 bbl. of oil through 12/64-in. choke. Top of the Strawn reef was 4,490 ft., on elevation of 2,382 ft.

In southeastern Nolan County, Mar-Tex 1 Cochran was reported dry at 6,712 ft., in the Ellenburger topped at 6,625 ft.

Nolan County had a new wildcat location as the Lamar Hunt Trustee Estate 1 R. B. Jones, 2 miles west of Maryneal in 175-1A-H&TC. Projected depth was 7,200 ft.

Gem Oil Co. located its 1 Emilo Martinez in 162-2-H&TC, 15 miles northwest of Rotan in Fisher County. Projected depth was 7,500 ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Brown County: Ellison Miles 1 E. W. Ariedge, N. B. Mitchell Sur. 150, TD 1,309 ft., pay 1,307 ft., IP pumped 36.7 bbl. 44°-gravity oil.

Coleman County: Walter Dunn 1 J. E. Estes, Sec. 23, J. Martin Sur. 752, TD 2,804 ft., Marble Falls 2,059 ft., IP 5,000,000 cu. ft. of gas.

Cooke County: T. P. Frost 5 E. G. Ramsey, B. Lusk Sur., A-569, TD 1,330 ft., pay 1,300 ft., IP pumped 100 bbl. 28°-gravity oil.

Jack County: F. Kirk Johnson A-1 Cherryhomes, J. Turner Sur., A-60, TD 5,738 ft., gas pay 5,345-58 ft., IP 7,100,000 cu. ft. of gas.

Rankin, Pitcock and Maguire 3 Laura Ainsworth, G. Stephenson Sur., A-523,

TD 4,467 ft., elev. 1,208 ft., Caddo 3,932 ft., IP 60 bbl. 41°-gravity oil, 11/64-in. choke, TP 650 psi., GOR 1,500 cu. ft.

Montague County: Jack Grace Production Co. 1 Mrs. J. C. Bryant, H. Frost Sur., A-263, TD 6,550 ft. pay 5,816 ft., IP pumped 285 bbl. 41°-gravity oil, GOR 410 cu. ft.

Taylor County: Saxon Exploration Co. 1 GC&SF, G. Hancock Sur. 430, TD 4,327 ft., elev. 1,950 ft., pay 3,940 ft., IP 215 bbl. 42°-gravity oil, 12/64-in. choke, TP 180 psi., GOR 480 cu. ft.

Throckmorton County: G. E. Kadane & Sons 3 Davis-Condron Unit, Sec. 1,620, TE&L, TD 3,461 ft., elev. 1,391 ft., pay sand 3,448 ft., IP 394 bbl. 39°-gravity oil, 3/4-in. choke, TP 350 psi., GOR 540 cu. ft.

Young County: Bridwell Oil Co. 3 Mrs. S. E. Snider, R. Wilson Sur. A-1,276, TD 3,646 ft., pay 3,636 ft., IP 168 bbl. 42°-gravity oil, 13/64-in. choke, TP 160 psi., GOR 350 cu. ft.

C. C. Elliott 4 J. R. Barnett, Blk. 186, TE&L, TD 1,021 ft., pay 1,019 ft., IP pumped 62 bbl. 38°-gravity oil.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: Cosden Petroleum Corp. 1-B J. R. Parkey, Blk. 41, Dallas CSL, dry, TD 5,583 ft.

J. B. Wilshire 1 Forena Kinder, Blk. 51, Clark & Plumb, dry, TD 4,036 ft.

Callahan County: J. J. Lynn 1 S. O. Montgomery, P. H. Gammons Sur. 214, dry, TD 4,029 gt., Caddo 2,994 ft., Barnett shale 3,685 ft.

Mid-Continent Petroleum Corp. 1-B Josie Brown, 1-2-SPRR, dry, TD 4,606 ft., elev. 1,922 ft.

Clay County: Rycade Oil Corp. 1 Mrs. J. W. Maddox, T. M. Hughes Sur., A-179, dry, TD 5,140 ft.

Coleman County: J. H. Blackwell 1 F. Cooley, Blk. 10, Chas. Shanks Sur. 243, dry, TD 1,265 ft.

L. H. Choate and Bankline Oil Co. 1-24 Mrs. Ballard, Blk. 24, J. F. Gordon Sur., dry, TD 3,167 ft.

D. L. Riley 1 W. M. Riley, Jr., J. H. Goodwin Sur. 667, dry, TD 2,001 ft.

Western Petroleum Co. et al 1 R. E. Coplen, J. H. Gibson Sur. 8, dry, TD 3,601 ft., Jennings 3,226 ft., Gardner 3,383 ft., Morris 3,092 ft.

Cooke County: The Texas Co. 1-A Danglelmayr, N. R. Sparks Sur., 1-A,496, dry, TD 2,850 ft., Ellenburger 2,557 ft.

Fisher County: Noranda Oil Corp. 1 Barto Jamison, 108-1-H&TC, dry, TD 5,682 ft., reef 5,503 ft.

Foard County: Texas Pacific Coal & Oil Co. 1 T. F. Welch, Nelson Box Sur., dry, TD 6,427 ft.

Haskell County: Blackwell Oil & Gas Co. 1 Loper, 51-1-H&TC, dry, TD 5,663 ft.

Dana & Shay 1 Schaefer, Sur. 9, D. McFadden Sur., dry, TD 4,878 ft., elev. 1,600 ft., Palo Pinto 3,255 ft., Caddo 4,840 ft.

Jack County: L. T. Burns 2 Roy Barry, Blk. 5, J. J. Chitwood Subd., J. Robbins Sur., dry, TD 3,053 ft.

Jones County: G. B. and James H. Rice 1 Schoenerstedt, Sec. 38, D&DAL, dry, TD 2,089 ft.

Sussex Oil Co. 1 B. P. Davenport, Sec. 4, BBB&C, dry, TD 3,583 ft., elev. 1,509 ft., Palo Pinto 3,565 ft.

Montague County: George S. Engle 1 C. M. McCall, Blk. 15, ETRR Sur., TD 6,467 ft.

Nolan County: Mar Tex Realization Corp. 1 Mrs. G. W. Cockran, 106-A-H&TC, dry, TD 6,712 ft., elev. 2,263 ft., reef 5,209 ft., Ellenburger 6,625 ft.

Palo Pinto County: Pete Shabay 1 R. E. Richardson, Sec. 1,792, TE&L, dry, TD 2,405 ft.

Parker County: Sunray Oil Corp. 1 B. F. Fletcher, E. E. Taylor Sur., A-2,473, dry, TD 6,244 ft., elev. 886 ft., Caddo 3,500 ft., estimated.

Faustgen Properties 1 C. B. Snyder, Jr., Sec. 34, LAL Sur., dry, TD 2,820 ft.

Chas. W. Inman 1 Tull Newcomb, 4-A-AB&M, dry, TD 1,875 ft.

Stonewall County: A. W. and Blair Cherry 1-B Dick Carson, Sec. 3, Seal & Morris Sur., dry, TD 4,736 ft.

Wichita County: Frank Wood 1 Pratt-Crites, HT&B Sur., A-478, dry, TD 2,001 ft.

Wilbarger County: Jack Grace Production Co. 1 Mary E. Jordan, 48-15-H&TC, dry, TD 5,600 ft.

Young County: T. V. Gorman 3 E. R. Prideaux, CTRR Sur., A-68, dry, TD 3,126 ft.

A. F. Knappenberger 1-A R. B. Whittenburg, J. M. Taylor Sur., dry, TD 4,460 ft., Barnett shale 4,320 ft., Mississippian 4,391 ft.

Lebus Bros. 1-B Nellie Prideaux, A. McMullen Sur., dry, TD 3,675 ft.

Martin Properties 1 R. A. Logan Blk. 2, J. Robinson Sur., dry, TD 3,545 ft.

Oklahoma

Another Discovery for Northwestern Oklahoma

THE northern Oklahoma portion of the Anadarko basin developed further interest this week as one discovery well was completed, an assured discovery was testing for completion, and two locations were announced.

The discovery completion was Continental Oil Co. et al 1 Kimball, NW NW SW 34-20n-16w. This wildcat in southwestern Major County, about 32 miles southwest of Ringwood field, was completed for 136 bbl. of 62.4°-gravity condensate and 2,236,000 cu. ft. of gas daily

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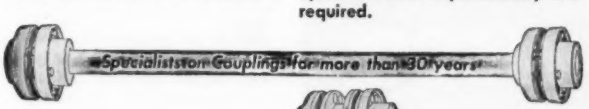

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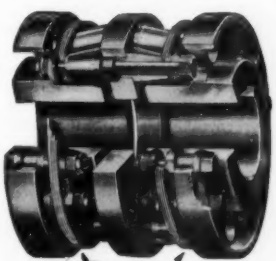

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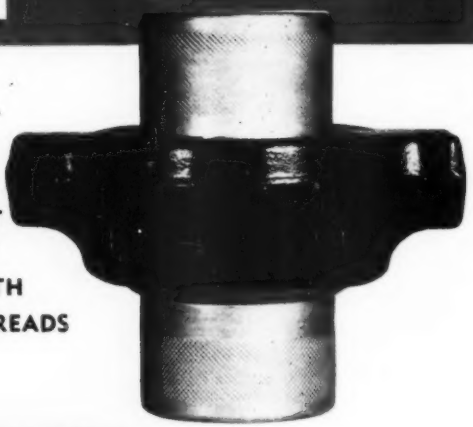

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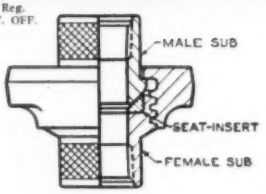

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through a 17/64-in. choke. This gas-condensate discovery is producing through perforations at 8,372-8,404 and 8,412-52 ft. in the Mississippian-Chester lime topped at 8,368 ft. The wildcat was drilled to a total depth of 11,861 ft. It has 7-in. casing set at 8,572 ft. and is plugged back to 8,536 ft. This new pool is to be called Northeast Seiling.

In Harper County, Sunray Oil Corp. is completing another gas-condensate discovery for the general area. Sunray 1 Wolfe, NW NE 4-25n-25w, flowed 47 bbl. of 68.2°-gravity condensate and 5,200,000 cu. ft. of gas daily through a 1-in. choke from perforations at 7,190-7,230 in the Pennsylvanian-Morrow. This assured discovery was drilled to a total depth of 8,242 ft. and has 5½-in. casing set at 7,315 ft.

Up in Beaver County, Carter Oil Co. 1 Grove, NW NE 6-5n-22eCM, southwest offset to discovery well of Greenough pool, is at a depth of 2,743 ft. The hole is being reamed to run intermediate string. Carter has announced intention to drill J. J. Tretbar, NW SE 2-5n-21eCM, about 2½ miles southwest of the discovery well of Greenough pool. Carter 1 Sharp, 31-6n-22eCM, recently flowed 455 bbl. of 40.4°-gravity oil on a 19-hour production test with a 35/64-in. choke for 13 hours and a 20/64-in. choke for the additional 6 hours. Sinclair Oil & Gas Co. has also announced a Beaver County test. Sinclair et al 1 Pearl Maple, SW NE 26-5n-24, eCM, about 7 miles east of Flynn Oil Co.'s Beaver Panhandle pool, is to test as deep as the Chester.

At Northeast Lone Grove pool in Carter County, Sinclair 1 Brown, SW NW 20-4s-1e, flowed 379 bbl. of 39.3°-gravity oil with 167,000 cu. ft. of gas daily through a ¾-in. choke from perforations at 5,624-66 ft. in the Dornick Hills. The discovery well of the field, Sinclair 1 Pruitt, NE SE NE 19-4s-1e, swabbed 36 bbl. of oil daily from the Deese at 2,246-66 ft. Sinclair has staked three locations for tests in the immediate area.

Sohio Petroleum 1 Henthorne, SE NW SE 7-1n-2w, outpost north of Eola field of Garvin County, flowed 527 bbl. of 35.9°-gravity oil daily through ¼-in. choke from the McLish at 8,741-8,897 ft., bottom of the hole. The gas-oil ratio was 704-1. The Bromide, at 8,350-8,725 ft., had previously flowed 312 bbl. daily through a 13/64-in. choke.

OKLAHOMA SUCCESSFUL WILDCAT

Lincoln County: Charles H. Mee 1 Mingus, NW NW NW 1-15n-3e, pumped 15 bbl. of oil from Red Fork 4,242-57 ft., TD 4,257 ft.

OKLAHOMA WILDCAT FAILURES

Carter County: L. C. Tharp 1 Pauline Simpson, SE SE NW 15-5s-3w, dry, TD 7,330 ft.

Cleveland County: Amerada Petroleum Corp. and Wilcox Oil Co. 1 Ermil Anderson, C SW NW 23-9n-3w, dry, TD 9,680 ft.

Cotton County: S. F. Hutcheson 1 Roy E. Adams, C NW SW 32-1s-11w, dry, TD 2,050 ft.

J. W. Carter and Geo. B. McCamey 1 Fred Bridges, SE NW NW 35-3s-10w, dry, TD 1,626 ft.

Hughes County: Bell Oil & Gas Co. 1 Thompson, SE SE NW 1-5n-8e, dry, TD 3,880 ft.

Jefferson County: D. H. Bolin 1 O. Barrett, NW NW NW 15-6s-6w, dry, TD 3,310 ft.

Lincoln County: Newt Barrett and Simon Bassett 1 Erwin, NW NW NE 29-15n-2e, dry, TD 5,420 ft.

Logan County: Hubbell and George Deck 1 Fruin, NE NE NW 17-16n-1e, dry, TD 5,582 ft.

Love County: The Texas Co. 1 Wallace, NW SE NW 1-8s-2w, dry, TD 8,876 ft.

Noble County: Deep Rock Oil Corp. 1 Reed, NE SE NW 23-21n-3e, dry, TD 4,305 ft.

Vickers Petroleum and Tom Sinclair 1 Freese, NW NW SE 10-21n-2w, dry, TD 5,204 ft.

Bert Ingram, Jr. et al 1 Wagner, SE NW SE 25-21n-2w, dry, TD 3,683 ft.

Pushmataha County: Rogers & Gunter 1 J. Moyer, NW SE SE 6-3e-16e, dry, TD 2,226 ft.

Permian Basin

Scurry Has Prospective Ellenburger Discovery

MIDLAND. — A prospective Ellenburger discovery in Scurry County, and many extensions to proven areas were in the week's developments.

The Ellenburger wildcat is Humble Oil & Refining Co. 1 James Davidson, 99-3-H&TC, northeast of Hermleigh, in the southeast section of the county. On elevation of 2,415 ft., top of the Ellenburger was 7,576 ft. Drill-stem test from 7,574-7,604 ft., open 23 minutes, had gas in 4 minutes and flowing oil in 15 minutes. There was no estimate on the flow. Recovery from the pipe was 7,250 ft. of 41°-gravity oil, plus 350 ft. of oil and gas-cut mud, with no formation water. Open flowing bottom-hole pressure was 1,360-2,890 psi. Operators were running electrical logs before setting casing.

North of Snyder and ¾-mile west of reef production, Stanolind Oil & Gas Co. 14 Cunningham, Section 613, completed in the Strawn for a pumping potential of 202.5 bbl. of oil a day.

Shell Oil Co. has completed its 1-A Sanger as a link-well about midway between the Aldwell fields of northwest Reagan County. Flowing potential was 147 bbl. of oil from pay at 7,625-76 ft. On elevation of 2,691 ft., top of pay was 7,634 ft.

In southeast Upton County, Tide Water Associated Oil Co. had a big producer and extension well at its 1-0 University, in 13-58-University Lands Survey, south of the Benedum field. Flowing potential was 829 bbl. of oil a day through ½-in. choke, from pay at 7,364-86 ft. Top of pay was 7,364 ft., on elevation of 2,654 ft.

A new Spraberry discovery, or long extension southwest of Pembrook and northwest of the Benedum field was indicated at E. Constantin 1 Oldham, wildcat in NW NW CCSD&RGNG. Operators set casing at 6,900 ft. and fratcured the upper Spraberry from 6,900-7,105 ft. The well kicked off while being swabbed and flowed at the rate of 10 bbl. of oil an hour through open tubing. It was shut in for storage. Total depth was 7,829 ft., in the lower Spraberry which had some oil, with water.

Coroco Drilling Co. 1 Atlas Life, Terry County wildcat which indicated 30 ft. of flush pay in the Devonian at 12,700-30 ft., and water and oil in the next 30 ft., had drilled to 13,020 ft. and was ready for further drill-stem testing. Good porosity was reported from 12,980-13,020 ft., in the lower Devonian.

Honolulu Oil Co. and Signal Oil & Gas Co. 5 J. E. Armes, ½-mile west extension on the southwest section of Ropes-Pennsylvanian field of Hockley County, developed flowing oil on a drill-stem test at 9,314-40 ft. Gas surfaced in 43 minutes, and oil and water cushion in 2 hours. The well cleaned into pits for 30 minutes, then gaged 66 bbl. of new oil in 2 hours.

Gulf Oil Corp. has filed application to drill its 3-SS TXL as a 13,250-ft., ½-mile southwest extension try to Pegasus field in Upton County. Location will be in 47-41-T4S-T&P, on an 800-acre lease.

Sinclair Oil & Gas Co. 1 TXL, wildcat in 19-41-T5S-T&P, swabbed 76 bbl. of new oil in 24 hours from perforations at 10,490-520 ft.

Gulf Oil Corp. 2-H McElroy, wildcat in 40-42-T5S-T&P, cored some porosity in lime and shale at 9,851-9,901 ft., and was drilling ahead.

Wilshire Oil Co. 1 Timmons, wildcat in 12-41-T5S-T&P, prepared to drill-stem test in the Spraberry from 7,686-7,785 ft., Top of the sand was 7,700 ft., on elevation of 2,865 ft.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCAT

Runnels County: Miami Operating Co., Inc. 1-A James, 17-533-N, Travis Sur., TD 2,468 ft., pay 2,460 ft., IP pumped 97 bbl. 43°-gravity oil.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Cochran County: Delta Drilling Co. 1 C. R. Starnes, Sec. 39, Harrison & Brown Sur., dry, TD 12,080 ft., elev. 3,814 ft., San Andres 4,320 ft.

Crockett County: Anton Oil Co. 1 Ed Bean, 64-OP-GC&SF, dry, TD 1,556 ft.

Dawson County: Gulf Oil Co. 1 Roberta Reeves, 6-1-J. Poitevent Sur., dry, TD 10,507 ft., elev. 2,866 ft., Spraberry 6,590 ft., base Woodford 10,429 ft.

Kimble County: Anzac Oil Corp. 1 H. H. Lawler, Kimble CSL, Sur. 751, dry, TD 2,173 ft., Caddo 1,690 ft., Ellenburger 2,068 ft.

Menard County: Dakota-Texas Co. et al 1 Crawford, Sec. 12, S. Mabry Sur., dry, TD 650 ft.

Dakota-Texas 1 Jewell Royal, Sec. 23, AB&M Sur., dry, TD 670 ft., Ellenburger 650 ft.

Pecos County: J. H. Mosser 1 University, 17-20-University, dry, TD 6,021 ft., elev. 2,448 ft., Pennsylvanian 5,116 ft., Ellenburger 5,906 ft.

A. E. Walker 2 R. W. Arnold, 18-1-H&TC, dry, TD 2,556 ft.

Runnels County: E. B. Fletcher 1 Mittie Rives, T. J. Hardeman Sur. 267, dry, TD 4,486 ft.

Giddens & Shriver 1 Ed Kasberg, Sec. 2, W. M. Jackson Sur., dry, TD 4,185 ft., elev. 1,695 ft., Palo Pinto 3,372 ft., Capps 3,719 ft.

Heep Oil Corp. 1 H. L. Speer, Sec. 402, J. E. Garvin Sur., dry, TD 4,481 ft., elev. 1,936 ft., reef 3,262 ft., Capps 4,267 ft., Goens 4,471 ft.

Sutton County: Wesley West 1 Williamson CSL, Williamson CSL 10, dry, TD 5,069 ft., elev. 2,246 ft., Strawn 3,882 ft., Ellenburger 4,977 ft.

Tom Green County: Cosden Petroleum Corp. 1 J. R. Mims, 79-6-H&GN, dry, TD 8,164 ft., elev. 2,386 ft., Canyon 6,955 ft., Strawn 7,340 ft., Ellenburger 8,030 ft.

The Texas Co. 1 P. W. Turner, 24-5-H&TC, dry, TD 7,718 ft., elev. 2,403 ft.

Upton County: John L. Greer Drilling Co. 1 Mayhew, 10-B-GC&SF, dry, TD 2,082 ft.

TEXAS PANHANDLE

J. M. Huber Corp. continues testing 1 Pazoureck, a promising Atoka sand (possibly Morrow) discovery 6 miles south of Olds, 13 miles southwest of Perryton in Ochiltree County. The new pool opener is located 1,980 ft. from east and south lines, Section 16, Block J-T, TWNG Survey.

The well is flowing at rate of 2,500 M.c.f. of gas per day with considerable condensate and oil present. Several more tests will be necessary before accurate gage can be taken.

Total depth is 8,096 ft. with 7⅝-in. casing cemented on bottom. The well was reopened in March and deepened from old total depth of 6,925 ft. to find pay. An offset location is scheduled in Section 19, south of the discovery.

Swab recoveries are averaging about 50 bbl. a day from Spergen perforations at 6,612-28 ft., 6,642-62 ft., and 6,676-6,734 ft. at The Texas Co. 1 Holt, new discovery 10 miles south of Hansford in Hutchinson County. Pool opener is located 1,980 ft. from north and west lines, Section 52, Block 5-T, T&NO Survey.

A new oil discovery is pumping with spudder at the rate of 60-70 bbl. of oil daily in the East Shamrock gas field area, 10 miles southeast of Shamrock in Collingsworth County. The new discovery is Leo J. Portman et al 1-A Gideon Bell, 330 ft. from west and 660 ft. from north lines of NW¼ Section 6, Block 13, H&GN Survey. Total depth is 2,113 ft. in Panhandle dolomite.

SOUTHEASTERN NEW MEXICO

Joseph I. O'Neill, Jr. 1-A State, Lea County wildcat, was testing for completion in the Wichita-Albany after finding water in the Ellenburger. The well flowed 31 bbl. of oil in 1½ hours from perforations at 7,440-48 ft. Total depth was 9,724 ft. Top of the Ellenburger was 9,580 ft., on elevation of 3,576 ft.

Humble Oil & Refining Co. 1 Elliott-Federal, Devonian exploration plugged back to test in the Pennsylvanian, gaged 3,120,000 cu. ft. of gas a day, plus 3.9 bbl. of distillate on 27/64-in. choke, from perforations at 13,120-35 and 13,140-75 ft.

A number of deep exploratory tests have been scheduled for early drilling. In Roosevelt County, Austral Oil Exploration Co. 1-AA Sadler, in 29-4s-32e, will go to 9,000 ft.

Gulf Oil Corp. and General American Oil Co. 1 Federal, will be a 13,500-ft. wildcat in northeast Eddy County. Location was reported as 24-17s-29e.

In Chaves County, Stanolind Oil & Gas Co. will drill its 1-Z State in 34-10s-31e, to 11,500 ft.

Lawton Oil Corp. had three wildcats planned for Lea County. These were: Number 1 State-Cities Service Co. in 11-11s-32e, to 10,600 ft. as a Devonian test; 2 State is in 10-13s-33e, contracted to 11,600 ft.; and 3 State will be drilled in 16-15s-33e, between Saunders and South Saunders field. Projected depth was 10,900 ft.

SOUTHEAST NEW MEXICO SUCCESSFUL WILDCAT

Lea County: The Texas Co. 1 J. H. Moore, 25-11s-32e, TD 10,475 ft., elev. 4,339 ft., Devonian 10,375 ft., pay 10,451 ft., IP 2,404 bbl. 48°-gravity oil, ½ and 1-in. chokes, TP 75 psi., GOR 66 cu. ft.

SOUTHEAST NEW MEXICO WILDCAT FAILURES

Eddy County: Fred Bond 1 G. G. Ison, 24-21s-27e, dry, TD 1,004 ft.

Lea County: The Texas Co. 1-AU State, 29-14s-32e, dry, TD 13,500 ft., elev. 4,359 ft. Wolfcamp 8,850 ft., Mississippian 12,490 ft., Devonian 13,120 ft.

The Texas Co. 1-BD State, 6-12s-32e, dry, TD 1,424 ft.

The Texas Co. 1-BE State, 6-12s-32e, dry, TD 11,950 ft., elev. 4,430 ft., Wolfcamp 8,480 ft., Mississippian 11,310 ft., Devonian 11,900 ft.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that 60 acres of acquired land of the United States in T. 11 N., R. 15 W., Michigan Meridian, Michigan, within the known geologic structure of the Cedar Creek gas field, undefined, will be offered for oil and gas leasing, through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p. m., Eastern Standard Time, June 4, 1952, when bids will be opened. Details of the lease offering, how and where to file bids, and a description of the lands may be obtained by addressing an inquiry to this office. Marion Clawson, Director.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that two tracts of land totaling approximately 160 acres in T. 37 N., R. 4 E., P.M., Montana, within the known geologic structure of the Whitlash field, will be offered for oil and gas leasing, through competitive bidding to the qualified bidders of the highest cash amounts per acre, at 1 p. m., Eastern Standard Time, May 21, 1952, when bids will be opened. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Land and Survey Office at Billings, Montana, or to this office. Marion Clawson, Director.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that lot 17, sec. 20, T. 10 N., R. 11 W., St. Stephens Meridian, Mississippi, 6.24 acres, within the known geologic structure of the Sharon field, undefined, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p.m., Eastern Standard Time, on May 28, 1952, when bids will be opened. Details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to this office. Marion Clawson, Director.

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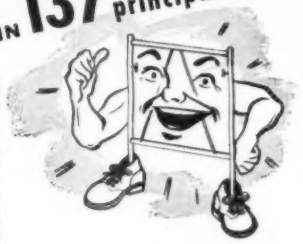

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Southwest Texas

Duval County Wildcat Drilling Ahead After Test

CORPUS CHRISTI.—C. G. Glasscock 1 Fee, wildcat 15 miles southeast of Realitos in Duval County, ran drill-stem test at 2,985-3,030 ft. Recovery was 150 ft. of oil and gas cut mud. This prospect is located in Santa Cruz de la Concepion Francisco Cordente Grant, Abstract 173. Projected depth is 4,500 ft. and operator is drilling ahead.

Phillips Petroleum Co. is drilling below 14,620 ft. at A-1 J. O. Washburn, deep wildcat in McMullen County 15 miles southeast of Fowlerton. Last core was pulled at 14,577-14,620 ft. after running electric log to 14,577 ft.

Final completion has been made at H. H. Howell 1 J. E. McClaugherty, oil discovery 2 miles northwest of Sandia in Jim Wells County. From perforations at 5,253-59 ft., the well flowed 198 bbl. of oil per day through 3/16-in. choke. Gravity of the crude was 40.5°, and gas-oil ratio was 365 to 1. Production is from the Vicksburg formation.

Across the Nueces River from this discovery, another well shows prospects of a discovery after recovering oil on drill-stem test. This venture, J. W. Gorman 2 B. W. Cox, in San Patricio Count, ran drill-stem test at 5,250-60 ft. Through 1/8-in. bottom and 1/4-in. top choke, recovery was 1,100 ft. of oil with working rpessure of 100 psi. Through the same size chokes, on another test, conducted at 5,262-68 ft., recovery was 300 ft. of oil and 40 ft. of salt water. Working pressure was 22 psi. This well is located in Delgado Survey, Abstract 4.

A Duval County gas discovery is waiting on potential test from perforations at 1,294-1,300 ft. Don H. Marsh et al B-1 Dolores Garcia, 20 miles southwest of San Diego, flowed gas through 1/4-in. choke under tubing pressure of 470 psi.

In the northwest corner of Jim Hogg County, Harold K. Boysen 1 R. Hinnant, wildcat, flowed dry gas on a drill-stem test at 2,042-46 ft. and operator is now coring ahead. On 15-minute test, using 1/4-in. chokes, working pressure was 85 psi. and bottomhole pressures were 100 psi., flowing and 550 psi., shutin.

One and one-half miles south of McAllen in Hidalgo County, Taylor Refining Co. & Mayfair Minerals, Inc., 1 Blanco Bales, has set 5 1/2-in. casing at total depth of 10,942 ft. and operators plan to deepen. This venture is projected to 12,000 ft. Location is in Hidalgo Canal Co. Subdivision.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCATS

Bexar County: gas discovery—MacDonna Development Co. 1 Berry Packing Co., S. A. Surburgan Irrigated Farms Subd., Blk. 63, TD 1,181 ft., perf. 1,227-81 ft., IP 460,000 cu. ft. of gas per day, open flow.

Brooks County: gas discovery—Humble Oil & Refining Co. 1 Robert J. Kleberg, Jr., Trustee, W. H. Schlake Sur. 96, TD 11,671 ft., perf. 11,545-55 ft., IP gas well, no gage.

Jim Wells County: oil discovery—H. H. Howell 1 J. E. McClaugherty, J. B. Dibrell Subd., Casa Blanca Grant, Blk. 74, TD 5,320 ft., perf. Vicksburg 5,253-59 ft., IP 109 bbl. oil per day, 40.5° gravity.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Aransas County: The Chicago Corp. 1 W. H. Wheeler, A. P. Davis Sur. A-54, dry, TD 8,505 ft.

Jim Hogg County: Sun Oil Co. 26 Weil Bros., CCSD&RGNG Sur. 247, dry, TD 5,303 ft.

Jim Wells County: Bridwell Oil Co. 1-A Gertrude H. Hoffhines, William Phillips Sur. A-349, dry, TD 4,303 ft.

W. Earl Rowe et al 1 J. H. Misenhimer,

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La Tinaja de Lara Grant, dry, TD 3,507 ft.

San Patricio County: Plymouth Oil Co. H-1 R. H. Welder, Phillip G. Young Subd. of E. H. Welder Ranch, dry, TD 8,523 ft.

Williamson County: Frio Petroleum Co. 1 Houghton Lawler, Simon Miller Sur., dry, TD 2,925 ft.

Wilson County: L. H. Armer 1 Ignatz Pawlik, Caspar Flores Grant 27, dry, TD 6,103 ft.

B. & G. Well Service Co. 1 A. T. Hardin et al, A. Green Sur., Blk. 275, dry, TD 2,917 ft.

Leveridge, Bilbo and Redding B-1 W. E. Harding "B," C. R. Patton Sur., dry, TD 2,739 ft.

Zapata County: A. L. Selig & Robert Mossbacher 1 Serapio Vela, Porcion 27, 28, Share 2, dry, TD 3,005 ft.

Rocky Mountain

Denver Basin Production Extended Eastward

DENVER.—A new discovery for the Denver-Julesburg basin has extended production eastward in the Colorado portion of this basin. Stanolind Oil & Gas Co. recovered 4,500,000 cu. ft. of gas daily on drill-stem test of the upper Muddy (D sand) at 1 Franklin, C SE SE 35-12n-44w, in the Chappel area, Sedgwick County, Colorado. The well is east of any previous production in Colorado but southwest of Big Springs gas field, Deuel County, Nebraska, where gas is produced from the D sand. In Logan County Plains Exploration Co. of Denver completed the Luft area discovery at 1 Luft, SW NE SW 17-8n-53w, for a flow gage of 305 bbl. of oil in 24 hours through ¼-in. choke. Tubing pressure was 80 psi. on the test. British-American Oil Producing Co.'s extension in West Peetz field, 1 Strange, NE NW SE 6-11n-52w, northern Logan County, was completed flowing 304 bbl. of oil in 24 hours through 28/64-in. choke on gas lift for the best completion in this field.

Amerada Petroleum Corp. has suspended operations at 1 Halverson, C NE SE 26-152n-96w, wildcat in the Keene area, south of Beaver Lodge field, McKenzie County, North Dakota, after the wildcat failed to produce from Madison. The well was drilled to 9,705 ft. with Madison topped at 8,859 ft. Amerada cemented casing at total depth and did selective perforating and testing up the hole. The last zone tested was 9,010-45 ft., which was acidized with 1,000 gal. and the operator swabbed 12 bbl. of salt and sulfur water from the zone in 34 hours. Amerada is continuing to test at the 1 Binhomer Risser, C SW SE 12-149n-96w, in southern McKenzie County. This well flowed 515 bbl. of oil in 46 hours through choke from the Devonian and was then plugged back for tests of the Madison. The well flowed 58 bbl. of oil and 3 of water in 17 hours through ¼-in. choke on latest tests in Madison from the zone 9,515-44 ft. Amerada has perforated 9,550-70 ft. and is now testing that zone.

Other wildcat wells in the Williston basin are apparently disappointing to the present depths. Stanolind Oil & Gas Co. is regaining lost circulation with total depth at 7,441 ft. at 1 Long Lake area, C SW SW 28-150n-80w, McLean County. This well topped Kibbey at 4,765 ft. and although shows were unofficially reported in Madison, the well has made water on all tests reported to the present depth. H. L. Hunt has abandoned 1 Wald, C SE SW 23-155n-81w, wildcat in Ward County with granite logged at 8,626 ft. Wannette Oil topped Charles at 5,070 ft. at 1 Lee, C NE NE 24-156n-85w, another wildcat in Ward County, and is reported drilling below 5,791 ft. Hunt topped Ashern at 5,650 ft. and is drilling below 5,746 ft. at 1 Lanertz, C NW SE 17-153n-77w, wildcat in McHenry County. No shows have been reported in the latter well.

In the Montana portion of the Williston basin five new locations have been announced during the past week, further increasing the exploratory program in the Richey, Cedar Creek, Pine and East Poplar areas. Shell Oil Co., and The Texas Co. have led in the wildcat program through this portion of the basin. The Texas Co. is below 10,048 ft. at 1 Maciorski, C NW SW 23-16n-50e, in the South Union area, Prairie County. On drill stem test 9,874-9,942 ft. in Devonian the well made 6,295 ft. of fresh water in 2 hours. Shell Oil Co. NPRR 22-25-B, E½ SE NW 25-22n-48e, wildcat in eastern McCone County, is at 8,297 ft., total depth, with the operator making drill-stem test. Last formation top reported was Charles at 6,800 ft. Shell found one pint of black oil on drill-stem test in the Charles between 6,405-43 ft., at 1 Little Beaver, C NE SW 13-4n-61e, Fallon County. This is the southern-most wildcat along the general Baker-Glendive anticline, and is just across the line from Bowman County in southwestern North Dakota.

WYOMING WILDCAT FAILURES

Washakie County, Bud Kimball: Brown & Langsdorf 1 Ainsworth, SE SW SE 8-44n-87w, completed as flowing water well, TD 1,040 ft. Tensleep 655 ft.

Nowood: Wyoming Oil Co. 1 Zeigler-Government, NE SW SW 8-48n-90w, dry, TD 2,437 ft. Tensleep 2,366 ft.

Buckhorn area: Seaboard Oil Co. 23-25 NE SW NW 25-48n-91w, dry, TD 5,388 Chugwater 4,106 ft., Dinwoody 4,943 ft., Tensleep 5,240 ft.

COLORADO SUCCESSFUL WILDCAT

Logan County, Luft field: Plains Exploration Co. 1 Luft, SW NE SW 17-8n-53w, flowed 305 bbl. of oil per day through ¼-in. choke, no water. TD 5,026 ft. "D" sand 4,837 ft., "J" sand 4,948 ft.

COLORADO WILDCAT FAILURE

Logan County: Davon Oil Corp. 1 North Sterling Irrigation Co., SW SW NE 10-9n-53w, dry, TD 4,987 ft. "D" sand 4,774 ft., "J" sand 4,880 ft.

MONTANA WILDCAT FAILURES

Roosevelt County, West Poplar: Carter Oil Co. 1 West Poplar, C NW SW 18-29n-50e, dry, TD 7,675 ft. Charles 5,680 ft., Madison 6,080 ft., Devonian 7,500 ft.

Rosebud County, Forsyth: Carter Oil Co. 1 Max Schenk, C NE SE 20-5n-40e, dry, TD 7,736 ft. Big Snowy 6,400 ft., Charles 6,520 ft., Madison 7,200 ft.

UTAH WILDCAT FAILURES

Emery County, Iron Wash: A. K. Wilson 1 State, SE SW SW 2-24s-13e, suspended until operations resume, TD 2,380 ft. Moenkopi 1,751 ft., Coconino 2,329 ft.

Garfield County, Muley Creek: The California Co. 1 Unit, C NE NE 18-36s-10e (SLM), dry, TD 8,362 ft. Redwall 7,177 ft., Devonian 7,805 ft., Cambrian 8,316 ft.

Millard County, Burbank: Standard Oil Co. of California 1 Unit, SE NE SE 3-22s-19w, dry, TD 6,955 ft. Eureka 6,128 ft., Laketown 4,742 ft., Pogonip 6,444 ft.

San Juan County, Hatch: Hathaway 1 Glasco Fed., N½ SW NE 5-39s-25e, dry, TD 7,621 ft.

Summit County, Evanston: Utah Southern Oil Co. 1 Hatch, SW SE NW 28-6n-8e, dry, TD 8,631 ft. Twin Creek 7,683 ft., Nugget 8,570 ft., water.

WESTERN NEBRASKA WILDCAT FAILURES

Cheyenne County: British-American Oil Producing Co. 1 L. B. Wilson, NW NW NW 27-17n-52w, dry, TD 5,535 ft. "J" sand 5,263 ft., Cloverly 5,500 ft.

Perkins County: Service Drilling Co. 1 Woodward, NW NW SE 5-9n-37w, dry, TD 3,274 ft. "J" sand 2,762 ft., Skull Creek 2,948 ft., "M" 3,004 ft., Morrison 3,229 ft.

NORTH DAKOTA WILDCAT FAILURE

McKenzie County, Keene area: Amerada Petroleum Corp. 1 Kermit Halverson, C NE SE 26-152n-96w, TD 9,705 ft., temporarily abandoned. Amsden 7,476 ft., Kibbey 8,000 ft., Charles salt 8,303 ft., Madison 8,959 ft.

Gulf Completes New Plant

PITTSBURGH.—Gulf Oil Corp. has completed its new canning, drumming, and blending plant at its present terminal on Ship Yard Creek, Charleston Harbor, Charleston, S. C.

The company also has bolstered existing tankage at the terminal with the addition of 20 new tanks ranging in capacity from 300 to 7,000 bbl. The new plant will blend and package motor and industrial oils for distribution in North and South Carolina and Georgia.

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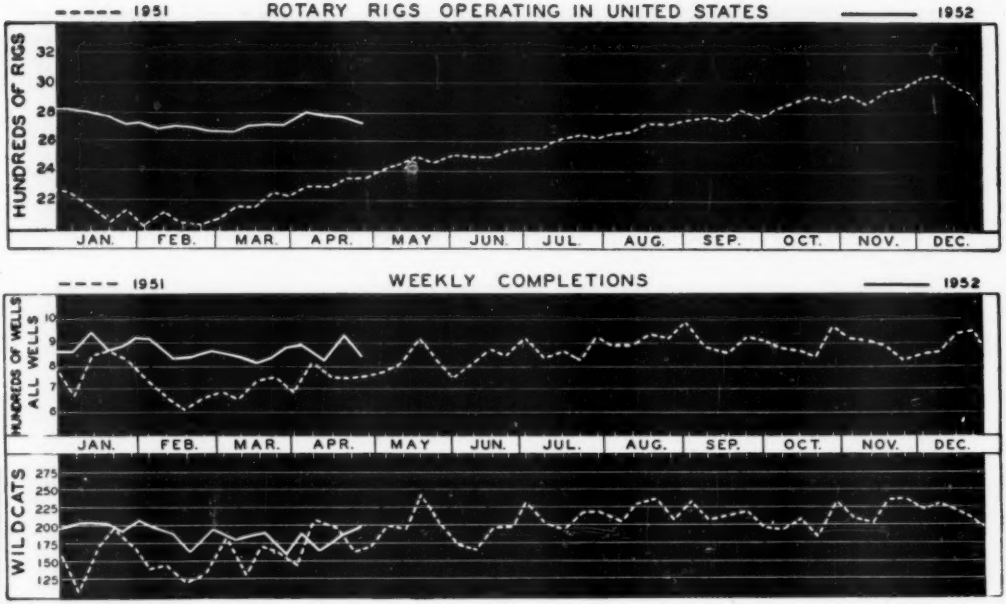


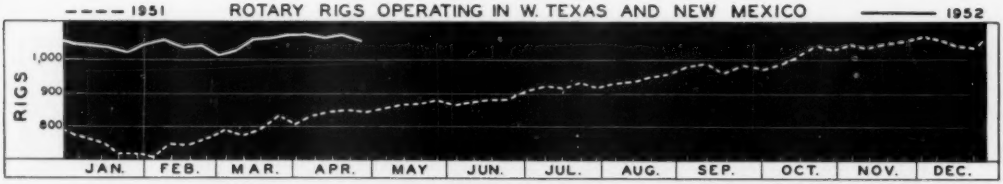
CURRENT STATISTICS

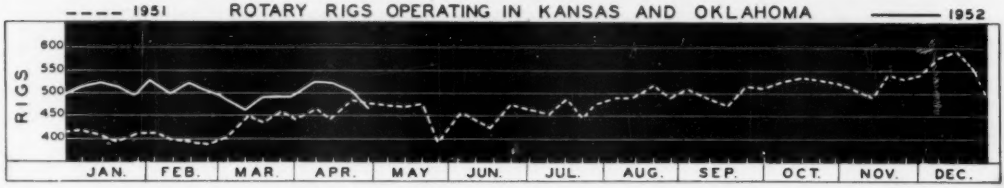
EXPLORATION

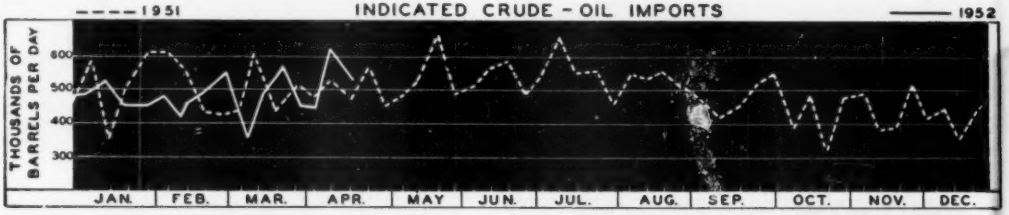
WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 26, 1952

	Total of all wells					Apr. 26		Wildcat completions and discoveries					Cumulative total, 1952				
	Comp.	Oil	Gas	Dry	Footage	1952	1951	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	20	10	0	*10	26,200	191	71	0	0	0	0	0	0	0	0	0	0
Pennsylvania	40	18	6	†16	79,000	522	248	0	0	0	0	0	0	0	0	2	2
West Virginia	10	0	10	0	38,132	215	179	0	0	0	0	0	0	0	2	1	3
Ohio	22	7	1	‡14	49,943	280	247	0	0	0	1	1	0	0	4	1	5
Indiana	23	10	0	13	40,303	333	294	0	0	0	4	4	11	0	2	103	116
Kentucky	28	9	5	14	46,901	386	250	0	0	0	4	4	8	0	0	65	73
Illinois	28	13	0	15	63,683	455	487	0	0	0	7	7	7	0	0	114	121
Michigan	17	8	1	8	48,999	212	212	1	0	0	6	7	10	0	1	76	87
Kansas	82	39	4	39	276,604	1,568	1,299	0	0	0	15	15	30	0	4	258	292
Nebraska	3	1	0	2	13,674	77	91	0	0	0	2	2	2	0	0	43	45
Oklahoma	92	46	2	‡44	360,536	1,977	1,745	1	0	0	13	14	33	1	6	208	248
Texas	349	195	17	137	1,740,889	5,752	5,083	12	2	6	83	103	262	27	42	1,210	1,541
North Central (Dist. 7-B & 9)	111	56	2	53	401,064	1,772	1,537	8	0	2	31	41	151	1	13	511	676
West (Dist. 7-C & 8)	104	81	0	23	593,256	1,780	1,551	1	0	0	15	16	46	0	3	207	256
Panhandle (Dist. 10)	9	4	3	2	26,631	215	225	0	0	0	0	0	1	0	2	19	22
Eastern (Dist. 5 & 6)	26	11	2	13	149,845	305	362	0	0	0	10	10	10	3	0	74	87
Gulf Coast (Dist. 2 & 3)	61	30	6	‡25	407,936	859	698	2	2	2	17	23	33	15	11	174	233
Southwest (Dist. 1 & 4)	38	13	4	21	162,157	821	710	1	0	2	10	13	21	8	13	225	267
Louisiana	28	14	3	11	196,125	717	633	0	0	1	7	8	14	6	4	80	104
Northern	16	6	3	7	75,931	388	308	0	0	1	4	5	6	0	4	34	44
Southern	12	8	0	4	120,194	329	325	0	0	0	3	3	8	6	0	46	60
Arkansas	5	3	0	2	21,218	121	122	0	0	0	2	2	4	0	0	18	22
Mississippi	6	2	0	4	39,147	129	77	0	0	0	4	4	6	1	1	48	56
Southeastern States	0	0	0	0	0	15	26	0	0	0	0	0	1	0	1	9	11
Montana	5	2	0	3	21,486	58	66	0	0	0	2	2	2	0	0	16	18
Wyoming	11	6	0	5	53,727	208	215	0	0	0	3	3	10	0	2	33	45
Colorado-Utah	12	5	0	7	69,441	166	82	1	0	0	6	7	8	0	4	53	65
New Mexico	18	7	5	6	144,541	308	217	1	0	0	4	5	10	0	1	27	38
California	44	33	2	9	180,806	831	635	1	0	0	9	10	34	0	1	150	185
North Dakota	1	0	0	1	9,705	7	2	0	0	0	1	1	1	0	0	3	4
Miscellaneous	0	0	0	0	0	22	12	0	0	0	0	0	0	0	6	9	15
Total United States	844	428	56	360	3,491,060	14,550	12,293	17	2	7	173	199	453	35	81	2,527	3,096
Total previous week	930	512	56	362	3,781,451			29	2	8	148	187	436	33	74	2,354	2,897
Total April 28, 1951	777	425	32	320	3,021,872			24	3	3	140	170	422	26	80	2,176	2,704

Service wells included: *10, †13, ‡1.



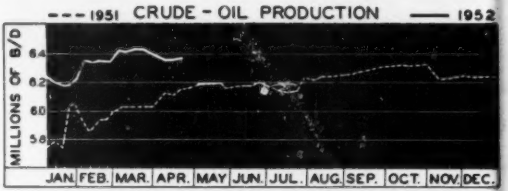


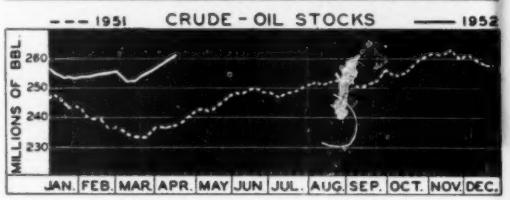


DAILY AVERAGE PRODUCTION FOR WEEK

	April 26, 1952 Crude oil	Lease Condensate	Total	April 19 total
Alabama	2,700		2,700	2,800
Arkansas	76,250	4,750	81,000	80,900
California	980,800		980,800	980,200
Colorado	86,800		86,800	83,600
Eastern	58,700		58,700	58,700
Florida	1,775		1,775	1,825
Illinois	168,300		168,300	167,200
Indiana	29,800		29,800	30,900
Kansas	317,900		317,900	315,200
Kentucky	35,500		35,500	35,600
Louisiana	624,700	39,200	663,900	662,300
North	114,200	14,200	128,400	126,800
South	510,500	25,000	535,500	535,500
Michigan	37,300		37,300	36,300
Mississippi	94,350	4,600	98,950	98,800
Montana	24,500		24,500	24,400
Nebraska	6,400		6,400	6,300
New Mexico	162,525	450	162,975	162,875
Oklahoma	530,800		530,800	531,200
Texas	2,842,850	45,325	2,888,175	2,888,175
Dist. 1	33,750	200	33,950	33,950
Dist. 2	161,075	3,825	164,900	164,900
Dist. 3	467,550	25,500	493,050	493,050
Dist. 4	261,250	4,500	265,750	265,750
Dist. 5	60,900	400	61,300	61,300
Dist. 6	121,375	4,425	125,800	125,800
East Texas field	272,700		272,700	272,700
Dist. 7-B	89,500	100	89,600	89,600
Dist. 7-C	132,150	5,650	137,800	137,800
Dist. 8	998,425	275	998,700	998,700
Dist. 9	161,175	450	161,625	161,625
Dist. 10	83,000		83,000	83,000
Utah	4,000		4,000	3,950
Wyoming	193,000		193,000	192,500
North Dakota	1,000		1,000	800
Total U. S.	6,279,950	94,325	6,374,275	6,364,525
Change from previous week, up			9,750	
Canada	110,064		110,064	149,153
Total U. S production January 1-April 26			741,238,075 bbl.	
Same period last year (crude plus cond.)			*702,458,500 bbl.	

*Incl. 9,527,100 bbl. condensate.



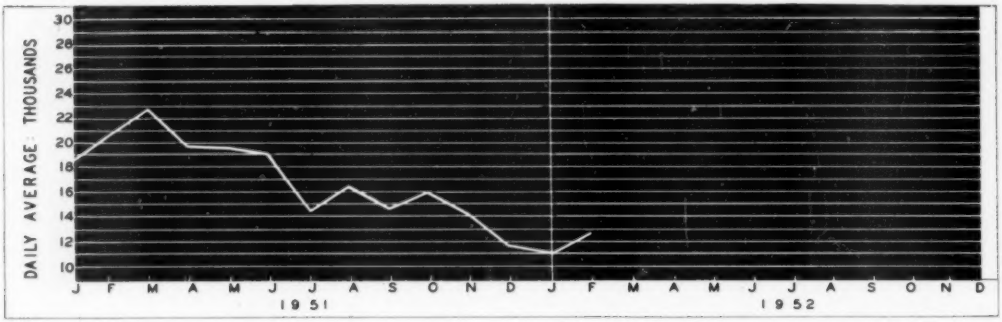


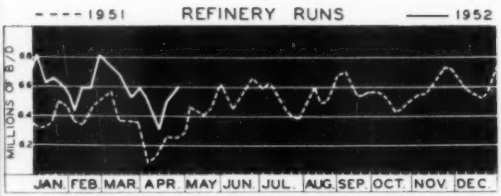
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

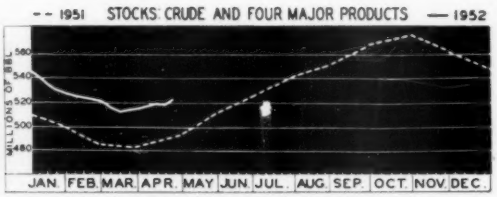
(Thousands of barrels)

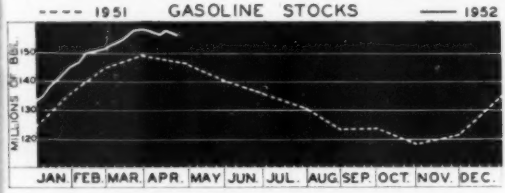
	Apr. 19, 1952	Apr. 12, 1952	Apr. 14, 1951
Pennsylvania Grade	2,408	2,321	2,051
Other Appalachian	2,446	2,112	1,465
Illinois, Indiana, Michigan	11,208	11,317	9,751
Arkansas	3,043	3,065	2,794
Louisiana	14,002	14,565	14,234
North	2,837	2,881	2,933
Gulf	11,165	11,684	11,301
Mississippi	3,627	3,432	3,136
New Mexico	7,444	7,529	6,918
Oklahoma and Kansas	41,120	40,277	36,906
Texas	124,840	123,692	110,420
East Texas proper	11,403	11,341	(†)
West Texas	55,615	54,908	(†)
Texas Gulf	26,256	26,173	(†)
Other Texas	31,523	31,270	(†)
Rocky Mountain	14,939	15,319	13,433
California	30,445	30,249	30,072
Foreign	7,269	7,026	9,010
Total	262,791	260,698	239,190

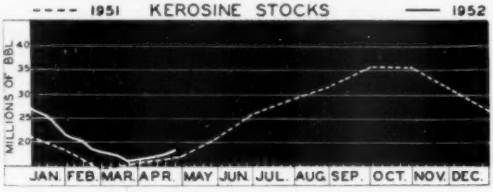
‡Bureau of Mines. †Not comparable with current week.

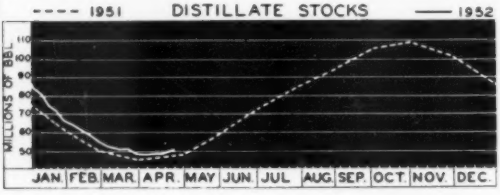


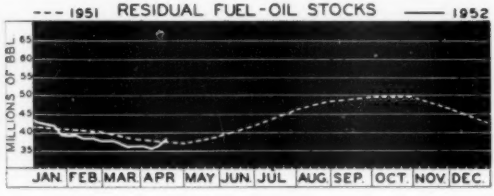










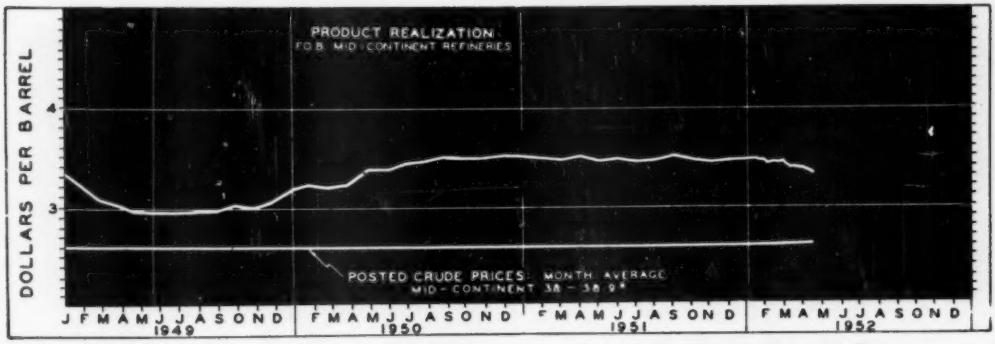


A.P.I. REFINERY REPORT, APRIL 26

(Thousands of barrels)

District—	Daily avg. crude runs	Daily average production: Gasoline*	Kerosine	Distillate	Residual	Stocks at refineries, bulk terminals, in transit and in pipe lines: Gasoline†	Kerosine	Distillate	Residual	Bureau of Mines, April 1951: Daily avg. crude runs	Daily average production: Gasoline*	Kerosine	Distillate	Residual
East Coast	1,018	386.6	39.3	199.0	228.6	32,433	8,019	16,473	10,473	962	380.2	47.5	208.2	211.5
Appalachian:														
District 1	94	41.6	5.9	12.3	11.1	3,863	417	565	500	105	46.2	6.8	14.2	11.4
District 2	56	32.1	1.3	12.0	13.1	2,056	172	339	103	76	36.6	4.8	12.1	15.2
Ind., Ill., Ky.	1,190	612.7	68.6	196.6	180.0	35,995	3,031	8,254	4,887	1,117	580.2	75.6	186.0	175.3
Okla., Kans., Mo.	526	284.4	18.6	104.4	62.7	18,056	992	7,569	1,403	494	262.2	18.6	107.6	62.3
Inland Texas	249	174.2	11.4	40.4	37.7	6,700	346	1,098	699	238	142.8	14.9	37.4	45.4
Texas Gulf Coast	1,660	723.3	130.7	390.7	288.7	23,479	2,016	6,659	6,221	1,484	648.3	130.2	300.3	243.8
La. Gulf Coast	525	238.7	53.8	132.6	59.3	7,857	1,455	2,421	2,092	481	218.2	64.0	104.7	53.9
N. La. and Ark.	79	30.1	7.3	23.4	7.4	3,065	556	844	162	84	32.1	8.4	14.6	8.3
Rocky Mountain:														
New Mexico	17	10.1		1.9	3.9	162		56	37	15	8.2	0.3	2.7	3.6
Other Rocky Mtn.	196	80.3	7.1	39.4	37.2	5,676	275	1,215	943	185	92.0	2.3	38.2	42.9
California	990	372.0	6.6	166.7	360.9	16,025	305	5,821	10,916	942	394.0	10.3	145.3	356.7
April 26, 1952	6,600	2,986.1	359.6	1,319.4	1,290.6	155,367	18,546	51,274	38,526	6,183	2,821.0	383.7	1,171.3	1,230.3
April 19, 1952	6,501	3,043.3	388.6	1,303.3	1,279.7	157,392	17,321	49,358	36,828					
April 28, 1951	6,236	2,839.4	385.4	1,151.6	1,249.6	145,987	17,021	47,852	36,991					

*At refineries including natural blended. †Finished and unfinished.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
4
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1949
F M A M J J A S O N D
1950
F M A M J J A S O N D
1951
F M A M J J A S O N D
1952

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate, and fuel oil. Realization averaged $3.31 for week ended April 19, $3.34 for previous week, and $3.51 for April 1951. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of April 30, 1952. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10-10¼	12-12.75	10¾-11
Premium gasoline, 86-88 octane	11-11⅜	13.5-13.75	11¾-12
42-44 w.w. kerosine	8¾-9	10-10.1	9
No. 2 straw fuel oil	7¾-8	9-9.25	8
No. 6 residual	$1.30-1.40	$2.45-2.60	$1.75-1.90

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5½	5	5¼
Grade 18-55	6.6	6.1	6.35

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-13.5
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	29
200 vis., No. 3 neutral, 0-10 pp.	16.5

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t., neutral	31.5

WAX

Mid-Continent

132-134 A.M.P.	5.5

REDUCTION in refinery operations because of strikes at many plants has had a firming effect on gasoline in the Mid-Continent area but has had little influence on weak fuel markets.

Through most of the fourth week of April, gasoline at pipe-line terminals was being offered for open trading at many points through the North Central states. In most cases, the suppliers were paying demurrage on the product or would be paying for storage within a few days.

This condition existed up to about 2 days before the deadline for the strike. At that time, reports of negotiations indicated that many plants probably would be closed by the end of the month. As a result, some of the material was withdrawn from the open market.

The fact that there was no rush of orders for kerosine and No. 2 distillate just before the strike indicates that many of the secondary suppliers in North Central areas have enough of these products in storage to cover their immediate needs. Good material is reported to be available at prices of at least 0.5 cent below general refinery quotations. Heavy fuel continues as the softest of the four major products.

The reduction in Gulf-East Coast tanker rates has brought some increase in availability of kerosine and No. 2 fuel on the New York Harbor spot market. However, most of the material available for open trading is held by suppliers with price ceilings above the normal level of barge prices in the harbor. Many distributors and jobbers are looking for light heating oils at normal prices of 9 cents a gallon for No. 2 and 10 cents for kerosine since there is at least a possibility that ceilings will be higher by the first of June.

Spot tanker rates for single voyages have drifted lower in the past week, but the fact that quotations for consecutive voyages over the summer months are showing strength indicates that rates may not sink too low this summer. All of the low rates for single trips were for dirty vessels. Military requirements are preventing any surplus of clean tankers.

CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.93			
19-19.9	1.98			
20-20.9	2.03	$2.25		$2.13
21-21.9	2.07	2.27		2.14
22-22.9	2.12	2.29		2.16
23-23.9	2.18	2.31		2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel	
Kettleman Hills, California*	$2.80
Louisiana:	
Beauregard Parish	2.60
Cotton Valley (distillate)	2.65
Cotton Valley (crude)	2.70
Texas:	
East Texas	2.65
Pecos County (Yates)	2.35
Conroe	2.83
Van	2.49
Pennsylvania Grade:	
Bradford	4.25
Southwest Pennsylvania	3.82
West Virginia	3.76
Illinois Basin	2.77

*37°-37.9°

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PRESSURE-PROOF
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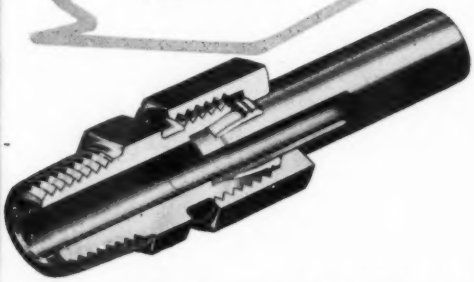
Fittings



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You will find this bulletin very helpful—a handy reference book with over 100 illustrations of various items.

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RESEARCH VACUUM SUPPLY COMPANY
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EQUIPMENT MEN . . . in the News

Baash-Ross Names Laird to High Sales Position

LEE J. LAIRD

Baash-Ross Tool Co. has announced that Lee J. Laird, in addition to managing California sales, has been appointed assistant general sales manager of the company.

In his new duties, Laird will not only cover the California area, but will travel extensively throughout the Rocky Mountain, Mid-Continent, and Gulf Coast areas assisting E. M. Gearke, general sales manager, in contacting the extensive areas served by the 17 manufacturing plants and branches maintained by Baash-Ross in the major oil territories of the United States. In addition, Laird will also assist in coordinating sales and advertising operations for the company, maintaining headquarters at Los Angeles.

Fullinwider Is Transferred To Mission Home Office

FULLINWIDER

T. R. (Ted) Fullinwider has been transferred to the home office of Mission Manufacturing Co., Houston, as a member of the sales department, W. T. Campbell, executive vice president of Mission, has announced.

Fullinwider has been with Mission for a number of years, and before being appointed to the Houston office he was sales representative in the Corpus Christi area.

Orbit Valve Makes Changes, Additions In Sales Staff

R. G. Cole, general sales manager for Orbit Valve Co., Tulsa, has announced the following changes and additions to the company's field sales staff.

Jack H. Hancock, who has been with Orbit since July 1947, is being transferred to Casper, Wyo., as field representative in the Rocky Mountain area. Hancock previously has been located at Chickasha, Okla., as representative in southern Oklahoma.

Claude W. Brown, Orbit representative in Kansas with headquarters at Great Bend, is transferring to Chickasha where he will replace Hancock. Brown has been on the sales staff of Orbit since October 1947.

In the Rocky Mountain area LeRoy Mitchell, distributor, has represented the company since 1947 and will continue with Hancock.

Cole has also announced the appointment of James P. (Jim) Bowling as city salesman for Houston. Bowling was formerly South Texas representative for Rector Well Equipment Co.

P.E.S.A. Holds First Meeting in Los Angeles

Over 70 salesmen, representing leading petroleum equipment firms, met recently in Los Angeles to inaugurate the new Petroleum Equipment Salesmen's Association.

James Hughes, general sales manager for Lane-Wells Co., spoke to the group on "Salesmanship" and encouraged the new organization's purpose.

Officers elected for the coming year were: D. H. Greenwood, Falcon Products, president; Jack E. Human, Associated Piping & Engineering Co., first vice president; H. J. Schlarb, Chiksan Co., second vice president; James C. Russell, Republic Supply Co., secretary; Harry D. Clelland, Oil Well Supply Co., treasurer; James A. Kennedy, Spang-Chalfant, Robert J. Glasscock, Walworth Co., and D. A. Stevenson, Mason - Neilan Regulator Co., directors.

Clarence S. Beesemyer, executive vice president of General Petroleum Corp., will address the next meeting of the association which will be held May 5.

D. H. Greenwood, Falcon Products Co., newly elected president of Petroleum Equipment Salesmen's Association, and James Hughes, Lane-Wells Co., speaker.

LeBus Elects New Officers

F. L. LEBUS, SR.

At a recent meeting of the board of directors of LeBus Rotary Tool Works, Inc., the following new officers were elected: Frank L. LeBus, Sr., chairman of the board; Frank L. LeBus, Jr., president and general plant manager; John S. Stammer, vice president; Earl J. Calk,

F. L. LEBUS, JR.

J. S. STAMMER

E. J. CALK

EVANS BURTON

general manager sales and service, and Evans Burton, secretary - treasurer and office manager.

Zink Sets October Date for Process Heating Seminar

Saturday, October 4, 1952, has been chosen as the date for the third annual John Zink Process Heating Seminar to be held at the John Zink Co. plant in Tulsa, according to officials of the company.

It was attended last year by more than 300 engineers and operating personnel from the refineries and chemical processing plants of the nation. The seminar provided papers on factors pertaining to process heating and steam generation. The presence of more than 300 at the second annual seminar represented a growth of 100 per cent over the first annual seminar.

This year's seminar, which will follow the pattern as set in the two

preceding years, will present a program of papers of current interest to the process industries. Authorities of national standing will prepare and read the papers. The usual buffet-style banquet, at which the entire group will be guests of John Zink, will follow the formal portion of the seminar.

Continental Announces Three Appointments

R. F. GREGG

Robert F. Gregg has been named district manager of Tubular Sales by Continental Supply Co., according to an announcement by Noble A. Endicott, vice president in charge of Gulf Coast operations, Houston. Prior to his new position Gregg was city salesman at Midland, Tex., and before that time he served as store manager at Snyder, Tex., and in various capacities at other store points.

Continental has also announced the appointment of Ralph A. Boussard as manager of the Houma, La., store under the direct supervision of Raleigh Hortensteine, Jr., assistant district manager, New Iberia, La.

R. A. Brewer, district manager, Tulsa, has announced the appointment of Warren G. Chapman as store manager at Pratt, Kans., under R. O. Hambric, assistant district manager, with headquarters at Wichita, Kans. Chapman has been serving as assistant store manager at Healdton, Okla.

Byrd Is Named Industrial Sales Representative

C. O. BYRD

Appointment of C. O. (Zeke) Byrd as industrial sales representative for Kelley Manufacturing Co., Houston, has been announced by James L. Whitcomb, executive vice president. Byrd's wide experience with oil-field equipment, gained as a field representative of Oil Well Supply Co., as well as a detailed knowledge of Kelley metal stampings, will benefit manufacturers throughout the Southwest. He will make his headquarters at the Kelley plant in Houston.

Cardwell Names Bridges To South American Post

The Cardwell Manufacturing Co., Inc., Wichita, has announced the appointment of James M. Bridges, as its South American representative.

Bridges joined Cardwell organization in February 1952. Prior to that time he was affiliated with Buda Co. as district sales representative at Corpus Christi, Tex., and as store manager. In December 1944 he opened the Buda export oil-field office in New York City. Four years later he became division manager of oil-field division, traveling the United States and Canada, and later district manager of the Texas subsidiary. In 1950 he returned to New York as manager of export, oil-field division, and Eastern domestic representative, at which post he remained until his present appointment.

B-J Appoints Hankins To Oil Tool Division

J. O. HANKINS

John O. Hankins has been appointed sales representative for the Oil Tool Division, Byron Jackson Co., Odessa, Tex., according to an announcement by B. A. Hilliard, sales manager.

Hankins became associated with Byron Jackson in 1946 in Los Angeles, where he worked with the engineering department as a service specialist. In October 1951 he was assigned to Odessa to assist in the installation and operation of special equipment.

Collett to Head New Division For Stewart & Stevenson

W. B. COLLETT

According to Joe Manning, general manager for Stewart & Stevenson Services, W. B. Collett has been appointed manager of the company's newly expanded irrigation division. Collett will make his headquarters in San Juan.

The irrigation division serves all of Texas. The new division has been expanded to provide better service for Stewart & Stevenson customers throughout the state.

Rosson-Richards Opens New Yard at Charlotte

Rosson-Richards Co.'s newest pipe-coating and wrapping yard.

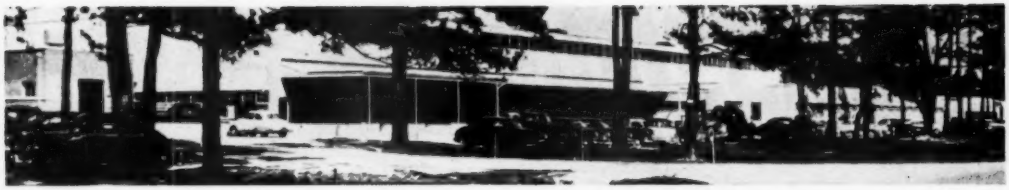
John Rosson and (Dutch) Richards of Rosson-Richards Co. have announced the opening of a new pipe-coating and wrapping yard in Charlotte, N. C. Other yards are located at Jackson, Miss., Corpus Christi, and Houston.

The modern Charlotte installation will serve the many oil and gas companies located in the Piedmont area. It has the capacity to coat and wrap from 10,000 to 30,000 ft. of pipe per day in a range of pipe sizes from 30 in. down to ¾-in.

J. R. Meyers is in charge of the plant, which is now in operation.

Walker to Manage New National Supply Store

The National Supply Co. has opened a store in Abilene, Tex., which will serve all of Callahan, Haskell, Jones, Nolan, Stonewall, Taylor, and Coleman counties, and parts of Fisher, Shackelford, and Runnels counties. J. R. Walker, former sales representative at Abilene, has been named store manager. The store is under the supervision of J. E. Warden, district manager of the Wichita Falls district. Three field representatives will work from the new location. Facilities at the new store include a completely equipped shop for servicing downwell pumps.



New million-dollar plant of Houston Oxygen Co., at Houston. At extreme left is the carbide and acetylene warehouse building. To the extreme right are the new plants of two associate companies: Big Three Welding Equipment Co., and Smithweld Co.

Houston Oxygen Completes Plant

Anticipating the rapidly expanding needs of the Southwest's industrial development, Houston Oxygen Co. has put in operation its new million-dollar plant for the production of pure liquid oxygen and liquid nitrogen, and pure oxygen, nitrogen, and argon gases.

Simultanously, meters started ticking on the world's first pipe line to supply multiple industrial customers with pure, dry oxygen gas.

The oxygen industry utilizes the world's only free raw product, air. The temperature of liquid oxygen, as drawn from final processing, is —183° C., 329° F. below the freezing point of water, and it rapidly and constantly evaporates. Liquid oxygen cannot be stored or carried in a sealed vessel because the creation of vapor is continuous and it would, if confined, build up a pressure and cause a violent and dangerous explosion. It is stored in heavily insulted tanks to resist temperature loss and consequent evaporation.

Liquid nitrogen is as colorless as water, but otherwise looks and acts very much like liquid oxygen. Its temperature, as drawn from final processing, is —196° C., and it must be handled similarly to liquid oxygen.

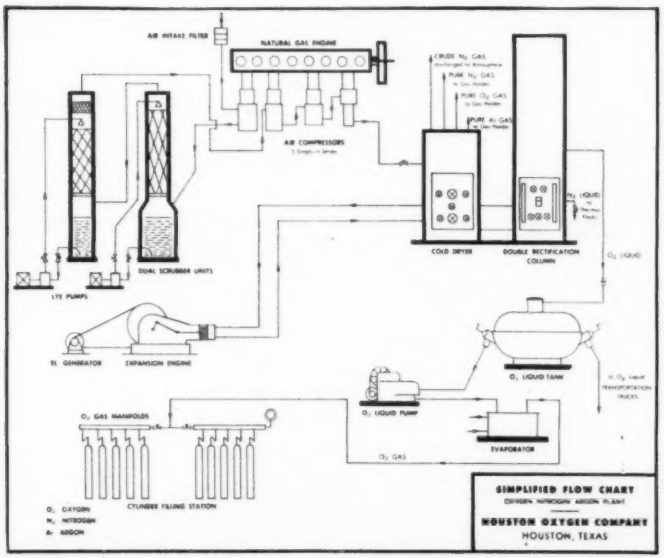
Part of the dry oxygen gas produced here feeds the new Industrial oxygen pipe line which has just been placed in service. From Houston Oxygen Co.'s new plant, the 3-in. oxygen pipe line runs southeast and already supplies many large plants.

The pipe line is laid almost to the intersection of Hempstead and Katy roads, and rights-of-way have been granted to extend it another 4 miles due west along Katy road to supply other industrial oxygen users in that area.

This pipe line has been tested under 200 psi. but it is operated under 100 psi. Dry oxygen gas of 99.5 per cent or better purity is delivered to customers, each of whom has a meter for measuring its consumption.

The use of such central system oxygen and acetylene lines within industrial plants will be greatly increased by this company's new facilities for providing customers, not served by their pipe lines, with large banks of as many as 50 permanently placed tubes, each 20 ft. long, for the storage of oxygen.

Officials of Houston Oxygen Co., who put into operation a new million-dollar liquid oxygen plant at Houston, are Alfred K. Smith, president; Cyrus K. Rickel, vice president; Harry K. Smith, director; and Al Herzstein, secretary-treasurer and general manager.



Houston Oxygen is completing the building of a fleet of specially constructed tank trucks to carry liquid oxygen under atmospheric pressure to the customer's permanently placed storage bank. One such truck will carry a load of liquid oxygen equivalent to former capacity of eight trucks.

These liquid oxygen trucks will be used also to supply large and moderate-sized users of industrial oxygen, each of which is set up with a liquid oxygen storage tank and a converter unit to generate dry oxygen gas right on their own premises, for use as needed.

The executives of this company are all officials also of a group of eight other affiliated companies. The largest of these is Big Three Welding Equipment Co. of Houston and Fort Worth and 16 other key cities. Houston Oxygen Co.'s new plant adjoins Big Three's new Houston plant, opened just last October.

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FOR SALE: Wilson Giant Draw Works: 2—Buda JL-1335 Motors with chain compound; 2—Code Butane Tanks; 4 Sheave National Traveling Block; 1—HP-217 Buda Engine; 5000' 4½" Drill Pipe. All in good drilling condition. Powell Drilling Company, 306 Derby Bldg., Wichita, Kansas.

FOR SALE: 6 New 20,000 Gal. Underwriters Steel Storage Tanks, 5/16" plate, welded. 10'6" dia. x 31' long. Located Springfield, Missouri, and Newark, N. J. Owner L. M. Stanhope, Rosemont, Penna.

BUCYRUS-ERIE 36-L Semi-Trailer mounted complete accessories, lines and 8⅝" pipe. Phone 1590, Box 617, Okmulgee, Okla.

FOR SALE

3—CT14L 22.5 - hp. Cabot twin - crank, used, pumping units. 54" maximum stroke, complete with U6 International engines.

1—30-hp. Ideco 54"-stroke, single reduction twin crank pumping unit, complete with 503 Fairbanks-Morse engine.

All material in good shape.

OVERTON SUPPLY CO.
Box 545 — Phone 2721
Overton, Texas

Equipment Values!

ENGINE-POWER UNIT—Cat Diesel D13000Y, open type clutch, outboard bearing, 15½x16" fibre pulley, and safety shutoff group. Runs excellent—looks right. FOB Louisville.....$3,850.00

MOTOR GRADER—Caterpillar No. 12, with cab and V-type scarifier. Excellent rubber. Good operating shape—a real value. FOB Louisville.$7,250.00

BUCKET LOADER—Nelson, portable, Mod. K-5, powered by LeRoi Model D140F7 gas. engine. Unit mounted on 4 pneumatic tires, 6.50x16 front, 9.00x24 rear, all in good condition. Complete unit ready for work. FOB Louisville.....$3,240.00

PUMP—Goulds, multiple stage, Figure 3330, 5" size, bronze fitted, 480 GPM against 300 ft. head. FOB Louisville $500.00

ENGINE-POWER UNIT—Cat Diesel D13000X, enclosed type clutch, 14x16" fibre pulley. Good operating condition. FOB Louisville.....$3,700.00

TRACTOR-DOZER — Caterpillar D6, wide ga., equipped with Southwest straight cable dozer, LeTourneau DDPCU, crankcase guard, front pull hook, large idlers, heavy duty equalizer spring, 18" grouser shoes. A very good, late model D6. A bargain. FOB Ashland, Ky. $5,885.00

ROY C.
WHAYNE
SUPPLY CO.
800 W. MAIN ST., LOUISVILLE, KY.

EQUIPMENT FOR SALE

GEO. FAILING core drill unit, Model 44, mounted on Ford truck. Complete with pipe and equipment. Kelly Heyen, Dorchester, Ill.

FOR SALE: Good 3½" and 4½" OD Drill pipe. Two EKU Waukesha's, One RL Cardwell, Hercules Engine, Tanks, Treaters, Pumping units. Rogers Pipe & Supply Co., 620 Wright Bldg., Tulsa, Oklahoma.

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EQUIPMENT FOR SALE

7500' OF API Full Hole 4½" Drill Pipe. Graded and tested by Sonoscope engineers. Milford Giffin, Giffin Hotel, Tel. 477, Hoisington, Kansas.

FOR SALE at our Oklahoma City Warehouse, Three 9½" x 14" VTH Used Clark Compressor Cylinders from angle compressors. Cities Service Oil Co., Patridge, Bartlesville, Okla.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

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Phones: 132—Rockdale, Texas
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Designed and fabricated by Braun to stabilize 6,000 bbls./day 67° API gravity crude.

Design:	API-ASME code 200 psi W.P., 400° F., 375 psi Test
Dimensions:	66" x 59', .750" Shell, .750" Semi-Ellip. Heads, 30 trays on 18" spacing, Weight 47,500#
Nozzles:	One 6" feed, one 3" reflux, one 8" vapors, one 8" bottom, one 10" vapor-return and two 3" relief-valves.

Heat Exchangers

Braun, horizontal, removable tube bundle, seamless admiralty tubes, cast-semi-steel body.
4—18" ID x 12', 4 pass tubes 250 psi, 2 pass body 200 psi
2—15" ID x 12', 2 pass tubes 100 psi, 2 pass body 200 psi
2—22" ID x 15', 6 pass tubes 100 psi, 2 pass body 200 psi

Reboiler

Braun, kettle type, removable tube bundle, seamless admiralty tubes, steel body, 26" x 48" x 21', 2 pass tubes 300 psi, body 200 psi at 400° F.

Steam Pumps

1—National Transite, Duplex, 8 x 4 x 12
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2—Burnham, Simplex, 8 x 7 x 20

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FOR SALE: New Bovaird and Company double eccentric and single eccentric pumping powers at Garnett, Kansas. For price contact A. L. Rhodes, Deep Rock Oil Corporation, Garnett, Kansas, or Joe Huitt, Tulsa.

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Franks SAL-5000 rig. 2 NHS Cummins diesel engines. Franks rotary rig 96 feet. Jackknife derrick. Provided with pump drive. Good condition. Ready for immediate delivery. Box E-726, The Oil and Gas Journal, Tulsa, Oklahoma.

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One (1) New fractionating tower, 5' 0" I.D. x 89' 6" over-all height x 1⅛" plate. Thirty-four (34) bubble trays, ten (10) 18" 300# manways. Stress relieved and built in accordance with API-ASME Code for 350 PSI working pressure. Located Watt Metal and Boiler Works, Houston Shops.

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Good as new, for immediate delivery. One 80,000 BBL. Seven Ring all steel tank for $25,000.00. Three 55,000 BBL. Five Ring all steel tanks for $17,500.00 each. As is where is and subject to prior sale. We will also cut down and re-erect as welded tanks either of the 55,000 BBL. tanks above for $38,500.00. Or we will cut down and re-erect the 80,000 BBL. as a welded tank for $50,250.00. These are rivited tanks and of standard construction and may be inspected now near Shreveport, La. Contact by mail or phone

CLYDE DAMPF, INC.
Box 2515, Amarillo, Texas. Phone 3-5050

EQUIPMENT FOR SALE

FOR SALE: Frederick, Oklahoma, Field—5 Used 122' American Type 66M Angle Iron Derricks, Mild Steel, Cap., 246,000# 6" x 6" x ½" Starting, 6" x 6" x ⅜" Running legs, with floorable platform, safety top and crown block. Standing. $750.00 Each. Cities Service Oil Co., Patridge, Bartlesville, Okla.

WELL SERVICING UNITS — Skid type, Single Drum Cardwells, Wilsons, Allis-Chalmers, Muskogee, Keltner, Double & Single Pole Mast. Have Draw Works on long skids w/ 86' Double Pole Rotary Mast for shallow well rotary. For sizes & prices—Write General Tool & Supply Co., P. O. Box 4387, Oklahoma City.

FOR SALE: 7¼x10 Gardner-Denver mud Pump, "FY-FXD." Skid mounted, V-belt driven by Climax R41 engine, Butane equipped. New 6½" liners and pistons. Ideal for Shallow Drilling to 3000'. Price $3,750.00. Located our yard, Grandfalls, Texas. Lasiter Drilling Company, Ph. 813, Box 1022, Del Rio, Texas.

PRESSURE VESSELS

Immediately Available

8—10' ID dia. x 40' x 3" shell. Heads 3½". Test Pressure 900 psi. WP 600 psi.

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8—8' ID dia. x 40' x 2" shell. Heads 2¼". Test Pressure 750 psi. WP 500 psi.

1—6' ID dia. x 40' x 2" shell. Heads 2¼". Test Pressure 750 psi. WP 500 psi.

All used, good condition, seam to seam, welded code construction. Built by A. O. Smith Corp. Located near Chicago, Ill. Prints, prices available on request.

WIRE—PHONE—WRITE

KINSLOW POWER & EQUIPMENT CO.
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Phone 5-5914

EQUIPMENT FOR SALE

2200 ft.—7"—24# Seamless good used Casing—$1.95 ft. Jay Kornfeld, 1121 Union National Bank Bldg., Wichita 2, Kansas. Phone: 4-2121.

FOR SALE: 36,000' 1¼" ID 3# PE SH Amonia pipe, regular random lengths, good condition. Richardson Supply Corp., 401 North Main, Tulsa. Telephone 3-6522.

FOR SALE: Ft. Worth Jumbo Spudder with or without tools. Good condition, priced to sell. Doak Drilling Company, Box 1108, Bristow, Oklahoma.

CATERPILLAR D-13000 Power Unit, open Clutch, Outboard Bearing, Rebuilt, priced right. Martin Tractor Company, Chanute, Kansas. Phone 73.

POWER PUMP: Rebuilt 7-P (7¼x18) Wilson-Synder, complete, oilbathed, short skids, #10657. Jones, Shelburne, Guffey, 501 N.E. 26th, Oklahoma City, Oklahoma. 5-5448.

USED PUMPING UNITS and engines. One Lufkin TC-1A-54B unit with Lufkin Cooper-Bessemer engine and one O.C.S. 40 H. P. Bat unit with Superior GB engine. Both are single reduction units. Located near Kermit, Texas. Cities Service Oil Co. (Penn.), P. O. Box 1117, Crane, Texas.

MOUNTED Rotary Drilling Rig, Dodge Truck. Complete 2000 foot capacity. Two men operate, fast, durable, efficient, roller-bearing throughout. Money maker shallow drilling, reverse circulation, clean-out. Box 106, Seminole, Oklahoma

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OPERATING REFINERY SKIMMING PLANT
ON OHIO RIVER
TROY, INDIANA
Crude presently available. Good markets and personnel. No labor troubles.
Box 535, Evansville, Indiana

NEW NATIONAL TRANSIT POWER PUMPS BARGAINS
No Priority Required
4 x 6—4,000# Plunger Load.
4½ x 6—6,000# Plunger Load.
5 x 10—7,000# Plunger Load.
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DISMANTLING GASOLINE PLANT

7—CLARK GAS ENGINE GAS COMPRESSORS

One—230 H.P.—17x18x26x20
One—230 H.P.—17x18x24x20
One—230 H.P.—17x18x24x20
One—200 H.P.—16x7½x10x20
One—165 H.P.—17x6½x16x20
One— 80 H.P.—16x8½x20
One— 80 H.P.—16x7½x20

Complete and in good operating condition.
Full specifications available on request.

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NEW STEEL TUBING

10,000 feet—4" O.D.
10 gauge wall
Electric Weld
20' lengths

10,000 feet—4" O.D.
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Electric Weld
with coating of asphalt and tar inside and out
40' lengths

60,000 feet—1" O.D.
18 gauge wall
Electric Weld
20' lengths

26" O.D. NEW STEEL PIPE
Continuous Electric Weld
.281" wall
Approximately 40 joints 40' each

All or any part of the above available for immediate shipment below warehouse prices. Subject to prior sale.

Write—Wire—Phone

Sonken-Galamba Corp.
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EQUIPMENT FOR SALE

FOR SALE: Westcott, Foxboro and Emco Gas Meters. George R. Milner, Box 124, Okmulgee, Oklahoma.

FOR SALE: Well Drilling Business—71 star, Modernized #3 Keystone, Both Truck Mounted. Complete Tools, 4 to 20 inch. Physical Inventory $15,000. Nets $6,000 to $8,000 yearly. This is Industrial—No Pipe Worries. Sale Price: $11,000.00. Owner retiring. Write Box E-594, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Walker-Neer Spudder S-32 Special, complete with tailing-in tools for 5" and 7" casing. Lines extra good. Dog house, light plant, float trailer. Complete tools for drilling, running tubing, sucker rods, etc. Butane equipped. Price $15,000.00. For inventory write Box 1022, Del Rio, Texas.

TWO pipe pulling machines, heavy duty double drum draw works. International Motors, spudding attachments to rip casing pipe break-out and cathead, 55' steel A-masts. Tools, 15 down spiders, tongs, elevators, stems, rippers, bailers. Phones 2-0061, 7-5013. 1323 East 26th Place, Tulsa, Okla.

USED well drilling equipment. We buy and sell spudders, rotaries, core drills, tools, pipe, blocks, pump jacks, everything for well drilling and service. All used equipment fully reconditioned. Contact us for your requirements and save money. We rent fishing tools. Pressey & Son, Pueblo, Colo.

FOR SALE: 20 pressure tanks 8' diameter X 16' high 3/8's welded and riveted construction—with mounted feet on sides. Top and bottom equipped with gasket pressure-type heads. 20 units available each $450.00 f.o.b. western Pennsylvania. Box E-737, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 1951 Reo Tandem Truck Model E216 with oil field bed and winch. Practically new. Box 204, Highland, Illinois.

FOR SALE: Portable Rotary Complete, Mounted on float, 2500' 2 7/8" Drill Pipe. Ready to drill. Box 204, Highland, Illinois.

USED rotary and cable tool drilling tools. E. A. Kelly, Box 861, Oklahoma City. Phone 4-6407

FOR SALE at Oklahoma City Garage: 1 Used 1937 Model Allis-Chalmers Model UE Tractor Well Servicing Unit, with large single drum, gas-gasoline carburetor, drum divider, 11.25 x 24 and 9.00 x 15 balloon tires. Serial No. UET380, Engine No. 47864. No mast. Ready to go. $1500.00. Cities Service Oil Co., Patridge, Bartlesville, Okla.

FOR SALE: 3000' of 3 1/2" modified drill pipe. Wichtex Draw Works, 65' mast, 17" Oil Well Rotary table, C-100 Ideal 6 1/4" X 10" mud pump with motor, PA-100 International Draw Works motor, GMC truck 2 1/2 ton tandem, Ford truck, 1 1/2 ton, oil field beds and winches. Have all necessary equip. for complete rig. Trade for production. Cash Price $27,500.00. Box 583, Ardmore, Oklahoma. Phone 4726.

WELL Drilling Rotaries and Spudders bought and sold. Immediate delivery in most cases. Specify your requirements. Contact Francisco Gonzalez, Baker Export Co., Box 1128, Pecos, Texas.

FOR SALE: 4—8 5/8" Orbit 1000# test 8 thread drilling valves. 41—5 1/2" Ditto. All used but in good condition. Michigan Gas Storage Co., 212 W. Michigan Ave., Jackson, Michigan.

STEEL STORAGE TANKS

11—55,000 bbl. Tanks—114' 6" dia. x 30' high

10—80,000 bbl. Tanks—117' 6" dia. x 41' high

All tanks steel roof, riveted construction throughout. Standing location near Mexia, Texas, and suitable for re-erection. Detailed specs. and prices available on request.

SOUTHERN IRON & METAL CO.
Box 3270, Beaumont, Texas

MID-STATES PIPE & SUPPLY CO.
Box 2534, Tulsa, Okla.

ROGERS & WRIGHT, INC.
215 Wright Bldg., Tulsa, Okla.

HORWITZ PIPE & STEEL CO.
Box 1466, Oklahoma City, Okla.

EQUIPMENT FOR SALE

FOR SALE: Wilson Super Winch, Waukesha power, 8" x 7" pole, mounted on Ford truck, complete set rod and tubing tools. Cleaveland Well Service, P.O. Box 308, Tel. 446, Luling, Texas.

EQUIPMENT WANTED

WANTED—Cardwell Trailerig, Box 1137, San Antonio, Texas.

WANTED—125-150 horsepower boiler 300# working pressure. Must be in good condition. Contact Leo Ekstrom, Anchor Gasoline Corporation, 714 Atlas Life Building, or phone 54-5201, Tulsa, Oklahoma.

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

1,400 FEET or less 3 1/2" EUE or 2 7/8" EUE drill pipe, new or good used. One 30 foot 4 3/4" drill collar, new or good used. Have PAD authorization for pipe. Box E-606, The Oil and Gas Journal, Tulsa, Oklahoma.

WE BUY well drilling equipment machines, cable tools, pipe, etc. Turn your surplus equipment into cash. Pressey & Son, Pueblo, Colorado.

WANTED: 2 or 3,000 ft. of range 1—2 7/8" or 3 1/2" drill pipe either used or new. Also wanted: 7 1/4 by 10 mud pump or something similar. Box 326, Princeton, Indiana.

WANTED: 2 Rotary Pumps, minimum 1000 bbl. hour Capacity for residual fuel oil. Box E-746, The Oil and Gas Journal, Tulsa, Oklahoma.

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Scale: 1 inch equals 4,000 feet

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EXPERIENCED Seismograph party chief. Interested in profit sharing with small organization. Box E-751, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

SMALL progressive engineering company requires petroleum engineer qualified for registration to supervise core analysis laboratory and engage in reservoir engineering. Permanent and good future for right man. Box E-739, The Oil and Gas Journal, Tulsa, Oklahoma.

CONSTRUCTION FOREMAN: Excellent opportunity for a competent man with experience in refinery construction and maintenance, preferably in Fluid Catalytic Cracking Plant. Write Northwestern Refining Co., P.O. Box 248, St. Paul Park, Minnesota.

EXPERIENCED engineer capable of designing and servicing Wellhead equipment such as separators, treaters, heaters and attendant equipment handling crude oil to storage. Location Tulsa area with progressive steel plate fabricator. Box E-752, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE DESIGN ENGINEER

To head Petroleum, Chemical, and Petro-Chemical Design Section of long established, progressive engineering-construction firm with headquarters in Southwest and operating internationally. Compensation to suit experience and ability. Must have proven record in directing work of others and dealing with major clients. Age minimum 35. Submit recent photograph and full education and business history. Replies held in strict confidence. Our staff advised of this inquiry. Address replies to Box E-728, The Oil and Gas Journal, Tulsa, Okla.

RESERVIOR ENGINEERS

Major Oil Company has openings in Venezuela for qualified Reservoir Engineers. Age 26-40, B.S. in Petroleum Engineering or equivalent. 5-7 years' exp.

Write giving full details to:

P. O. Box 35

Bowling Green Sta., N. Y. 4, N. Y.

Scheduling Engineer

Major petroleum refinery construction company located in New York has excellent opportunity for outstanding Scheduling Engineer with minimum 3-5 years' experience in job scheduling on petroleum or chemical plants: starting with engineering and proceeding through procurement and construction. Please submit complete resume, including past earnings record. Your reply is confidential. Our employes know of this ad.

Box E-729
The Oil and Gas Journal
Tulsa, Oklahoma

OPPORTUNITIES FOR TECHNICAL REFINERY PERSONNEL for LARGE INTERNATIONAL OIL COMPANY

Entertaining applications of graduate chemical, mechanical, structural and electrical engineers for refinery engineering assignments at home and abroad.

Engineers with refinery experience and also recent graduates will be considered.

Box E-667, The Oil and Gas Journal, Tulsa, Oklahoma

HELP WANTED

WANTED: An oil Driller to drill in Michigan and Arkansas on 49:51 share. Wonderful prospect in Arkansas, near El Dorado Oil Fields. Individual preferred, rather than Company driller. Would also like drilling Equipment on Rental Basis. H. C. Wells, 4732 Prairie Ave., Chicago, Ill.

WANTED ENGINEERS

WITH GOOD JOBS WHO WANT BETTER JOBS

Men with 2 to 5 years 'experience in petroleum, geological, chemical, mechanical, electrical engineering fields wanted by progressive oil and gas well service company to train for responsible positions in acidizing, perforating, fracturing, logging service. Training program begins June 1, last 4 to 12 months, depending upon previous experience of individual. Salary while training $450 to $600 a month, based on experience, qualifications and ability. Company now operating in West Texas, New Mexico, Oklahoma, Kansas; expanding immediaely into Rocky Mountain area. Advancement fast for those with ability. Write today giving experience, scholastic record, present employer, references and reasons for desiring change. Enclose photograph. Write to:

Box E-744
THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

HELP WANTED

OIL Industry Employment Service, 405 Tuloma Building, Tulsa, Okla., 4-5974, Tom Robinson, owner. For technically trained personnel. No Fees. Confidential. Needed now. Landmen with law degrees under 3 years experience. Geologist sufficient experience to head Geological Department. Substantial Independent. Experienced Petroleum Engineers. Excellent Employer.

WANTED: Experienced Reservoir Engineer by Independent Consulting Firm. In applying please state detailed experience and salary expected. Interest participation if qualified. Abilene Sample Log Service, Box 1939, Abilene, Texas.

MEN to train for service engineer to service hydraulic oil well pumping equipment in California oil fields. Experience in servicing oil field mechanical equipment essential. Some engineering education desirable but not essential. Excellent future for men selected. Give full details of experience in first letter. Box E-719, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Combination Safety Engineer and Metal Inspector. Southwest Refinery. Box E-681, The Oil and Gas Journal, Tulsa, Oklahoma.

MUD TECHNICIANS

Major oil company in Venezuela has openings for experienced mud technicians. Age 25-40; 2 years college and specialized training. 1-3 years' experience. Approximate annual earnings $8330.

Write giving full details to:

GULF OIL CORP.
Foreign Prod. Div.
P.O. Box No. 35, New York 4, N. Y.

HELP WANTED

RESERVOIR ENGINEER with over 5 years' experience, including field training. Independent California operator. Box E-748, The Oil and Gas Journal, Tulsa, Oklahoma.

NOW READY. List showing where to apply for foreign jobs with oil companies and general contractors. Write for price. OIML Co., Box 2603, Tulsa, Okla.

KEY Seismograph Personnel Needed by Established and Expanding Seismograph Company. Box E-616, The Oil and Gas Journal, Tulsa, Oklahoma.

VICE PRESIDENT, MARKETING. 50-58. Successful record in petroleum products. $25,000 - 30,000 Salary. Submit confidential record to Tomsett Associates, Executive Personnel Counselors. 331 Frick Building, Pittsburgh 19, Pa.

RAPIDLY expanding Company wants College graduate for Oil Country sales job. Must be between 27 & 35 years of age. Write stating qualifications and present position. All replies confidential. Box E-735, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE & TITLE MAN: Major Company, Illinois Basin, College education preferred, but not essential if experience adequate. Permanent position. Box E-727, The Oil & Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

EXPERIENCED oil field mechanic, gas, butane and Diesel engines, good references. Box E-734, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1628. Ph. No. 131, Hobbs, New Mexico.

REFINERY Superintendent, experienced 5,000 to 10,000 bbl. plants, desires connection with independent refinery. Box E-696, The Oil and Gas Journal, Tulsa, Oklahoma.

ACCOUNTANT or Office Manager: Fifteen years experience all phases of accounting through preparation of all records and statements and supervision of office personnel. Phone, Tulsa 4-5828, or Write Box E-749, The Oil and Gas Journal, Tulsa, Oklahoma.

LAWYER, 37, married, real estate training and experience, 11 years with major oil company desires employment with individual, partnership or small growing independent as landman. Write Box E-736, The Oil and Gas Journal, Tulsa, Okla.

ATTENTION: I would like to contact Independents, Individuals and Small Groups in the Tri-State area of the Illinois Basin who desire supervision and management of their Drilling, Completion and Production problems on a contract basis. Thoroughly experienced in this area. Recommendations furnished on request. Box E-738, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER, 3 years refinery experience, 1 year refinery design. Desire maintenance and construction coordination or supervisor in refinery. Box E-741, The Oil and Gas Journal, Tulsa, Oklahoma.

SUPERINTENDENT, general field operations available at once. Age 48, experience 20 years. Morals and ability unquestionable. Recently resigned former position. References. P. O. Box 1069, Houston 1, Texas.

PERSONNEL: Ten years' experience all phases personnel administration, including labor relations, wage-salary administration, job evaluation, training. Now employed but seeks greater opportunity. College and shop background. Box E-743, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL ASSISTANT to the President, Aide to wealthy individual Investor, Financial Manager or Assistant for individual or Corporation. M. B. A. Harvard Business School, Phi Beta Kappa. Excellent financial, Securities, general business and oil investing experience. New York City location preferred. Best references. **Box E-750, The Oil and Gas Journal, Tulsa, Oklahoma.**

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SITUATIONS WANTED

GEOLOGIST: 5 years' experience, surface, reserve estimates, subsurface. Venezuela, desires position Rocky Mountain Area. Age 31, married, references. Box E-723, The Oil and Gas Journal, Tulsa, Oklahoma.

SUPERINTENDENT desires connection with progressive independent. Experienced in Oil and Gas production and drilling. Petroleum Engineering degree. Box E-740, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE & TITLE MAN OIL PROMOTIONS & FINANCING WORK. University Graduate: LLB Degree, experience includes all phases lease and title work, financing promotions, development and management. U. S. & South American Oil Fields. Speak Spanish. Desire connection with aggressive independent company. Box E-745, The Oil and Gas Journal, Tulsa, Okla.

AGE 38, seventeen years' experience with major, independent, and drilling contractor as Petroleum Engineer, production superintendent, drilling superintendent, and general manager. Exceptional experience and acquaintance. Presently engaged in consulting work. Excellent references. Box E-753, The Oil and Gas Journal, Tulsa, Oklahoma.

16 YEARS' supervision in drilling and producing for major oil company, desire employment with reliable independent company. Prefer Oklahoma, Kansas, Texas, or New Mexico. Now employed in Canada. References. Box E-742, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY Engineer, Master's degree, desires supervisory position with independent refiner or related industry, over ten years' experience in refining and natural gasoline field. Age 36. Box E-732, The Oil and Gas Journal, Tulsa, Okla.

LEASE AND DRILLING BLOCKS

PROFIT participation offered to party submitting acceptable deal with shallow possibilities suitable for secondary recovery. Informant's name treated confidentially if desired. Contact SITCO, 801 Dallas National Bank Bldg., Dallas, Texas.

WANTED: Capital to increase production shallow lease. Present production five hundred barrels per month. Twelve more locations. Offering limited number 1/48 interest for seven hundred fifty dollars. W. Kyle, 1006 Dallas Ave., Houston, Texas.

PRODUCTION FOR SALE

We have several producing oil leases for sale in West Texas, on which there are many proven locations. Will furnish details to qualified buyers only—no brokers or promoters.

Box E-713
THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

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Bought and Sold—Any Area
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LEASE AND DRILLING BLOCKS

TWO LOTS north outskirts Snyder; two north outskirts Oklahoma City; one each Stanton, Latt, Quanah, Texas. Want drilling. V. A. Epps, Pioneer Hotel, Tucson, Arizona.

WE invite inquiries from persons interested in Oil and Gas Leases in Southern Alberta, North Central Montana and the Williston Basin. Box E-664, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver Colorado.

FOR LEASE: 3500 acres oil and gas land in Corbin, Sweetwater and Fremont Counties, Wyoming. Will sell equity. Write Joseph L. Lincecum, 817 W. Pine, Rawlins, Wyoming.

TWO Drilling Blocks 15,000 acres each on gravity and magnetometer surveyed highs located in South Georgia, open for drilling contract on farm-out or acreage to financially interested parties. Its a good gamble for **surplus tax money.** Tuscaloosa Sand has been drilled with good oil showing at 3,000 ft. in Georgia. If you are ready for a deal this is a good bet for shallow production. T. R. Davis, 700 Mosley Street, Vidalia, Georgia.

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NOTICE Capitol Investors: One oil property in the State of Texas. Price $200,000.00. Pays about $60,000.00 per year. Charlie Priolo, 2301 West 6th, Amarillo, Texas.

SKIRTING production north we are offering 10,000 choice acres in Cimarron County, Oklahoma, at a fair price. Box 1106, Amarillo, Texas.

PRODUCTION WANTED

Principals want to purchase production in Kansas, Oklahoma and Texas or corporate control of producing company operating those states. Inquiries invited from owners or responsible representatives.

Box E-731
The Oil and Gas Journal
Tulsa, Oklahoma

NORTH DAKOTA
LEASES and MINERALS

Our latest lists with prices mailed on request. We solicit only those connected with the Oil Industry, or Royalty business. References exchanged.

JOHN ALLEN
200 Grand Pacific Hotel Phone 3850
Bismarck, North Dakota

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Phone 40-226 Minot, North Dakota

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Send for list. Can offer Williston Basin minerals for $10 per acre with $1.00 annual rentals. Can sell in minimum tracts of 40 acres. Solicit sales only to those connected with oil or royalty business. References exchanged. Write or call Milburn & Milburn, Sewell Building, Telephone 6-6439, Odessa, Texas.

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EAST OKLAHOMA Hydrofrac Prospects. Geologist and company manager have data on shallow sands with employers permission to use. Are interested in venture with reliable parties to develop. Others please do not inquire. Box E-725, The Oil and Gas Journal, Tulsa, Oklahoma.

COMPANY with new warehouse and office facilities in Odessa and well established with Permian Basin Drilling and Production Accounts desires to represent manufacturer of production or drilling specialities. A more complete description of company's facilities and sales potential can be obtained by writing Box 2466, Odessa, Texas.

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Box E-709, The Oil and Gas Journal, Tulsa, Oklahoma

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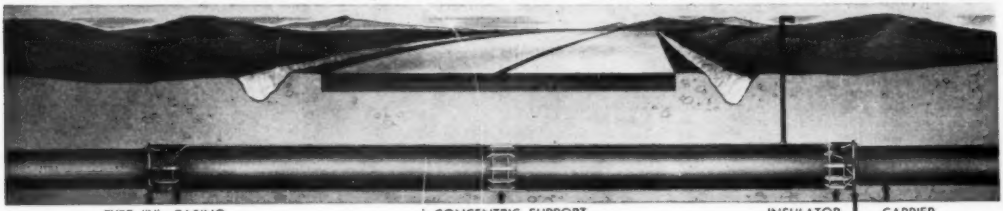
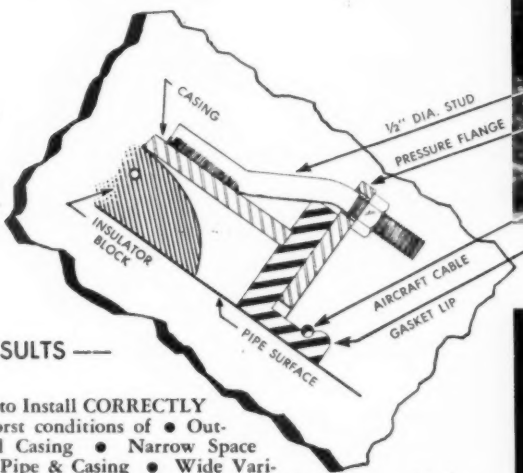


TYPE "L" WmSEAL CASING BUSHING*

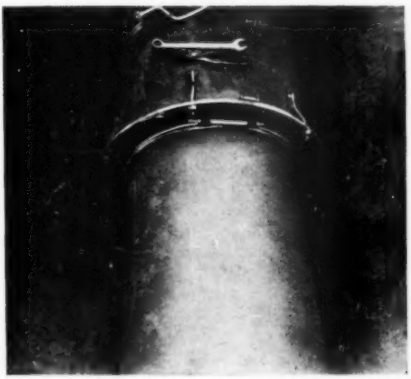
A New Design: It BUTTS Against End of Casing Instead of Fitting Inside the Casing.

Assembling cable with rubber-covered union for clamping gasket lip to pipe.



RESULTS ——

1. Easier to Install CORRECTLY under worst conditions of • Out-Of-Round Casing • Narrow Space Between Pipe & Casing • Wide Variations in Casing Wall and Coating Thickness • Mud • Casing ends beveled — by machine or hand torch.
2. WATER-TIGHT Seal with "L" gasket . . . . . .
   - BUTTED AGAINST CASING as pressure flange is tightened on ½" studs welded to casing.
   - TIGHT TO THE PIPE as aircraft cable (4,600# tensile) is tightened to gasket lip. Union is rubber covered to INSULATE galvanized cable assembly from bare casing structure.
3. Always Insulated from the pipe line when a Concentric-Support Insulator is installed just inside casing after the "drag section" is in place.



THE COMPLETED INSTALLATION
Note that galvanized cable and union are insulated from pressure flange and from pipe.

AS STRONG & DEPENDABLE AS THE MEN WHO INSTALL THEM

REPRESENTATIVES

Stuart Steel Protection Corp. Kenilworth N. J.	H. E. Davis Los Angeles 15, Calif.	James S. Kone Co. Amarillo, Texas	Keyes Tank Co. Provo, Utah	Keyes Tank & Supply Co. Casper, Wyoming	Canadian Equipment Sales & Service Co., Ltd. Edmonton, Calgary, Toronto, Canada

*Patent Pending

WRITE FOR BULLETIN 249A

T. D. Williamson, Inc.
TULSA 9, OKLAHOMA

8,000 Pipe Line Casings installed in 1951 with Williamson Bushings and Insulators

The BEST Line for Rotary Drilling ...TRU-LAY Preformed

● For each use there is *one best* wire rope . . . one that will stand repeated loading, abrasion, crushing, or continuous bending, and be the best to buy.

To achieve this, there is a TRU-LAY Preformed Wire Rope made in 6x19 Seale, improved plow steel with steel core for your equipment. This construction has the exactly right combination of strength, bending life, and resistance to wear and crushing that you need.

The one best drilling line . . . TRU-LAY Preformed . . . will last you longer and cost less to use. Specify and get TRU-LAY Preformed.

Write for folder DH-209.

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AMERICAN CABLE DIVISION
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TRADE MARK

Wilkes-Barre, Pa., Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

skeletons we don't try to hide

A scrap pile is something you wouldn't expect a manufacturer to advertise. It's different at Hughes! We're proud of our rock bit scrap pile!

It shows that our inspectors are alert . . . that faulty bits are discovered before they can cost you valuable drilling time . . . or become expensive failures in the hole.

The cones shown above, in various stages of manufacture, were rejected in one of 40 or more separate inspections that started with the bar stock*.

Counting all parts, more than 275 inspections—*including the use of electronic inspection equipment*—are made to assure the dependability of the finished bits.

There are 253 inspectors at Hughes. They have an average of ten years' experience.

This is another example of the care that goes into the manufacture of all HUGHES Rock Bits. And another reason why they are accepted as the "Standard of the Industry" throughout the world.

*This valuable high alloy scrap is shipped weekly to mills for remelting.

HUGHES Tri-Cone ROCK BITS